TRANSACTIONS

OF THE

NINTH ANNUAL MEETING

OF THE

AMERICAN LARYNGOLOGICAL ASSOCIATION

HELD IN THE CITY OF NEW YORK

MAY 26, 27, AND 28

1887

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TRANSACTIONS

OF THE

NINTH ANNUAL MEETING

OF THE

AMERICAN LARYNGOLOGICAL ASSOCIATION,

HELD IN THE HALL OF THE NEW YORK ACADEMY OF MEDICINE, MAY 26, 27, AND 28, 1887.

First Day—Morning Session.

The Ninth Annual Congress of the American Laryngological Association was opened, at ten o'clock on the morning of Thursday, May 26, 1887, by the President, Dr. E. Fletcher Ingals, who occupied the chair.

The Secretary proceeded to call the roll, the following Fellows being present during the meeting:

E. Fletcher Ingals, Chicago, President.
E. Carroll Morgan, Washington, Vice-President.
John N. Mackenzie, Baltimore, Vice-President.
D. Bryson Delavan, New York, Secretary and Treasurer.
Thomas R. French, Brooklyn, Librarian.
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S. H. Chapman, New Haven.
T. A. De Blois, Boston.
F. Donaldson, Jr., Baltimore.
W. F. Duncan, New York.
W. C. Glasgow, St. Louis.
J. H. Hartman, Baltimore.

U. G. Hitchcock, New York.
Edgar Holden, Newark.
F. L. Ives, New York.
W. C. Jarvis, New York.
C. H. Knight, New York.
F. I. Knight, Boston.
S. W. Langmaid, Boston.
G. M. Lefferts, New York.
R. P. Lincoln, New York.
A. W. MacCoy, Philadelphia.
C. C. Rice, New York.
J. O. Roe, Rochester.
C. E. Sajous, Philadelphia.
C. Seiler, Philadelphia.
B. F. Westbrook, Brooklyn.

Among the guests of the Association present during its proceedings may be mentioned Professor A. Jacobi and Professor M. Allen Starr, of New York, and Dr. Ryerson, of Toronto, Canada.

As the formal opening of the Congress, Dr. E. Fletcher Ingals proceeded to deliver the Annual

PRESIDENT'S ADDRESS.

Fellows of the American Laryngological Association:

We have here assembled to-day in our ninth annual congress to renew our acquaintance with each other, to cement our friendships, and to bring here the fruits of our experience and study in relieving the pains, alleviating the distress, promoting the happiness, and prolonging the lives of our fellow-men. What we have accomplished during the year is only partially told by the large number of papers which will be brought before us; but it will be more fully brought out by the discussions which they may excite.

We heartily welcome each other, and on behalf of the association I extend to the profession of this city a cordial invitation to our meetings.

As I was not present last year, I avail myself of this my first opportunity to thank you for the honor which you have conferred upon me—an honor which would have been prized at any time, but is now prized a thousandfold more because it was so unexpectedly and generously bestowed.

In reviewing the year I find that we have many causes of congratulation. First of all, we thank a kind Providence that our ranks

are unbroken, and that our fellows of last year all remain. I have to congratulate you that our association stands unrivaled for the fidelity and zeal of its members, and that it is now, more than ever before, a power for the advancement of our science and the good of mankind.

The profession of medicine has been and is generous, and I have to congratulate you that in our association there has been no estrangement from the general profession; but that we are members of this grand brotherhood, entitled to receive and glad to give all of its amenities, and I am glad to see that with each succeeding year the feeling of fraternity is growing stronger and stronger. Our association is to be congratulated upon the wisdom of its council, which has avoided entangling alliances with cliques and factions of every sort, and has judiciously settled all misunderstandings among ourselves. But we are especially to be congratulated upon the good judgment, the zeal, and the untiring energy of our secretary, to whom we are largely indebted for much of our success in recent years, and whom we have to thank for nearly all the work in preparing for the present meeting.

This occasion affords me a fitting opportunity to speak of some matters of interest to us as an association, which I will present to you briefly. At a recent meeting of the council steps were taken to secure papers from our corresponding fellows, which we believe will add to the interest of our meetings. Several weeks ago your president wrote each of these gentlemen, and received partial promises of two papers for the present meeting, but I fear that in this alone we are to be disappointed.

As most of you are aware, a joint meeting of the various special medical societies of this country has been arranged for next year in the city of Washington, and a committee from this association has pledged us to that meeting. It is designed that the association of special societies shall meet triennially at the capital; but the associations entering into this arrangement retain their autonomy, and may at any time withdraw if thought best. Therefore, I can see no possible objection to the arrangement, but, on the contrary, there seems every reason to believe that it will be a most satisfactory and useful meeting.

At our present session you will be called upon to vote on an amendment to our by-laws, by which it is proposed to increase the limit of our membership. There will necessarily be much honest difference of opinion on the wisdom of this change; but I have no doubt the final decision of the majority will be for the best. Some

of our fellows believe, with a limited membership as at present, that greater honor will attach to each individual, that greater interest will be felt by each in the quality of our work, and that better men will be elected to fill vacancies as they may occur from time to time. They believe that, consequently, the association will accomplish more than would be possible under other conditions. On the other hand, some of our fellows believe that a larger number would furnish more valuable contributions to medical literature than is now possible; and they think it unfair to close our doors to many laryngologists who do not now belong to the association.

Only a few years ago, when our association was organized, hardly a score of laryngologists could be found in the whole country; but now there is hardly a town or city of as many as twenty thousand inhabitants that has not one or more so-called specialists, who are devoting much of their time to laryngology. Some of these are well qualified for their work; but, unfortunately, others, immediately after graduation, settled down to practicing a specialty, and claimed extraordinary knowledge of the diseases of the upper air-passages. Between these two extremes there is every shade and variety. Considering, however, the number who are honestly doing the best they can in this department, we must admit the force of the argument in favor of the proposed change; but when we scan the current literature we see but few worthy articles on subjects pertaining to this specialty not written by those already members of this association.

These facts suggest that a middle course might best be pursued by the association which would partially meet the views of those upon both sides of this question. If the proposed amendment were to restrict the accession to our membership to one or two each year, besides filling the vacancies which will come with the natural course of events, we would be enabled to provide rapidly enough for those who would make valuable members of our association, and we would thus stimulate to extra effort those desirous of attaining the distinction which might thus be conferred upon them.

Another subject which should receive the careful consideration of every member refers to the times and places of our annual meetings. With our inborn and inbred republican principles we gracefully submit to the will of the majority, but with our inherent love of fairness we naturally ask consideration for the minority.

Your president is happy to say that in the past all have been fairly considered, but he believes as our membership changes it would be better if some settled policy could be adopted by the association

that would insure an arrangement of the times and places of our meetings that would accommodate all our members at least once in four years. Of our present members nearly three fourths who live east of the Alleghanies would be best accommodated by having the meetings held in some of the Eastern cities. A little over one fourth live west of the Alleghanies, and would be best accommodated by meetings in the Mississippi valley. Therefore it would seem best for the interests of the association if every fourth meeting were to be held in the West, and the others in such of the Eastern cities as might desire them. The time of meeting might better be left to the council, by whom it should be fixed in February or March of each year, after consultation by circular letters with all the members. It would probably be found that some would prefer the meetings to be held in the early part of May, some perhaps in September, and others at intermediate dates, but every third or fourth year all could be accommodated.

There seems to have been a little dissatisfaction among some of our members as to the manner in which papers presented at our annual meetings have been published. The complaints have been that these papers do not appear promptly enough and that they are not widely circulated. With reference to the first, I would call attention to the fact that our proceedings are reported briefly in all of the prominent journals directly after the meeting, and if any particular paper is slighted in these reports it is doubtless due either to the fatigue of the reporter or to the belief of the editor that the article would not be of interest to general practitioners. As a matter of course, the editor of the "New York Medical Journal" is obliged to distribute our papers throughout the year, and it has happened that papers from the same author have been deferred several months on two successive years; hence some of the complaint. This matter can not be adjusted perfectly, but the gentlemen who have charge of the publication will do all they can to make it satisfactory to all. A strong argument in favor of the continuance of our present arrangement is that, by giving all our papers to one journal, we secure the publication of our transactions in a permanent form at a small expense, whereas if our papers were sent to various journals we would be obliged to pay the full cost of publication for our transactions, which would necessitate an annoying or even burdensome assessment each year that could not be compensated for by the trifling advantages which in some cases the author might gain by publishing his article elsewhere. As to the circulation of the journal in which our papers are printed there is an

evident misapprehension; though it has not the largest circulation of all of the weekly journals, probably, with a single exception, it is as favored as any of them, and in character it is second to none. After all, the circulation of a journal is not of very great importance, for if an article is of general interest it is sure to be abstracted for other journals. I think that when our members reflect on the advantages of our present plan of publication, they will be satisfied that it is wise and judicious.

The absence of a table of contents from our earlier transactions has doubtless been a source of inconvenience to many of us. I am informed by the secretary that this might still be remedied at only a small cost. It has seemed to me that the value of our yearly transactions would be much enhanced by an accurate index for each, and I would suggest that, if practicable, future volumes be thus completed.

I can not better finish this address than by presenting for your consideration a comparatively recent addition to our means for combating that most baleful of mortal diseases, diphtheritic laryngitis, by O'Dwyer's method—known as intubation of the larynx.

Paper.

INTUBATION OF THE LARYNX.

By E. FLETCHER INGALS, M. D.

IN 1858 an attempt was made by M. Bouchut, of Paris, to treat stenosis of the larynx by intubation. As the result of his experiments he reported seven cases to the Academy of Medicine, of which five were fatal and but two ended in recovery after the subsequent performance of tracheotomy. Although these results were unsatisfactory, had M. Bouchut displayed the perseverance, patience, and moderation which have characterized the author of more recent experiments, he might then have demonstrated the practical utility of the method; but, in his zeal for the new operation, he unfortunately attacked tracheotomy and brought upon himself and his method the severe criticisms of those who had seen much good accomplished by opening the trachea. Trousseau, as secretary of the commission appointed to investigate the new operation, reported:

1. Tubage of the larynx in certain cases of acute laryngitis can, by retarding asphyxia, prove of curative value.

2. In certain chronic diseases of the larynx it may allow one to delay tracheotomy, and may sometimes relieve or cure the patient.

3. In the treatment of croup it delays asphyxia and allows an easier introduction of air, and the administration of agents capable of modifying the diphtheritic inflammation.

4. It can only very rarely supplant tracheotomy, which is the principal means of opposing croup when medical measures fail.

The last declaration proved the text for a discussion which was "an extinguishment of M. Bouchut's views and methods," and intubation of the larynx was condemned as an impracticable procedure.

In M. Bouchut's experiments a tube was used from 18 to 24 millimetres long, and from 6 to 8 millimetres wide, narrowed at one end. This was pressed into the larynx on the end of a hollow sound, a thread having first been attached to it to prevent its passage into the trachea, and to facilitate its removal. This thread was brought out through the mouth, and seems to have been the cause of much irritation; but the larynx was tolerant of the tube. Previous to Bouchut's experiments and since that date, catheters have been frequently used to prevent suffocation from closure of the glottis. As early as 1801 Desault accidentally learned of the tolerance of the larynx and trachea for a foreign body of this sort by passing a tube through the nose into the trachea, instead of into the œsophagus, as he had intended. The tube remained in that position for several hours, and he only became aware of its situation upon attempting to introduce food.

This accident suggested the possibility of treating laryngeal stenosis similarly. He experimented and reported two cases. The first patient was relieved temporarily, but died the same day the catheter was introduced. His second, who had œdema of the glottis, recovered, the catheter having been retained in the trachea for a day and a half.

Within the last few years Schroetter has successfully treated chronic stenosis of the larynx by the use of hollow three-sided bougies.

In 1880 Dr. William McLean, of Glasgow, reported three cases in which he had used a catheter in the larynx, one end of which protruded from the mouth. In one case the catheter was used during a surgical operation to prevent blood from flowing into the trachea. In the second case a No. 12 catheter was retained thirty hours, and in the third thirty-six hours.

Numerous other physicians have practiced catheterization of the larynx, but with no great success.

Dr. Joseph O'Dwyer, of New York, in 1880 began a series of experiments with intubation, which have resulted in giving to the profession one of the most useful operations of modern times. He first tried a bivalve elliptical tube with narrow transverse diameter, and having a head to prevent it from slipping into the trachea. But the membrane soon protruded between the blades, and there was a consequent return of dyspnœa. Retaining the head, he next made plain tubes about an inch in length. These were employed in three cases which he reported: The first was that of an infant, aged two months and twenty-four days, suffering from suffocative diphtheritic croup; relief was promptly obtained, but the child died in seventeen hours. The second case was that of a girl aged three years and a half, who was suffering from urgent dyspnœa. She made a rapid recovery. The third case was that of a boy aged four years; he died in twenty-four hours. At the autopsy the lower end of the cannula was found obstructed by a thick deposit of membrane. This showed the necessity for longer tubes. They were made and tried, but in a large proportion of the cases they were soon coughed out. A tube was then tried having a wedge-shaped piece of metal on either side to make it self-retaining, but it was held so firmly in the larynx that it could only be removed with great difficulty. Dr. O'Dwyer then conceived the idea of fusiform tubes which, with slight modifications, were like those in use at the present time. His present set of instruments consists of a gag, five laryngeal tubes, an applicator, an extractor, and a gauge. The tubes vary in length from an inch and a half to two inches and a half, the caliber of the largest being about one eighth by one quarter inch, that of the smallest about one half that size. At the upper end of the tube is a diamond-shaped head, with rounded angles, which rests upon the ventricular bands and prevents the tube from slipping into the trachea. The anterior aspect of the head is beveled off where it rests against the base of the epiglottis, and at its anterior part is a small eye through which a double thread is passed during its introduction. About the middle of the tube is a fusiform enlargement, designed to make it self-retaining. Jointed obturators accompany each tube, the distal end of which is rounded and of a size to close the caliber of the tube. At the proximal end also the obturator is enlarged to accurately fit the tube, and in its base is a small hole into which the end of the applicator is screwed when the tube is to be

introduced. The stem of the applicator is covered by a sliding tube, which may be crowded forward by a thumb-piece to release the obturator from the laryngeal tube when the latter is in position in the glottis. The extractor is constructed on the principle of a dilator. When in use the closed blades are passed into the end of the laryngeal tube; a lever on the handle is then pressed down to open the blades, which impinge against the inner aspect of the tube and hold it firmly so that it may be withdrawn. The gauge is used in determining the size of tube necessary for a child of any given age.

You will find no difficulty in doing intubation; but those not familiar with laryngology will find it profitable to practice on the cadaver before attempting it on the living subject.

The Operation.—The child should be wrapped in a shawl and held in the nurse's lap, with the head thrown slightly backward against her left shoulder. The gag is then placed between the jaws on the left side of the patient's mouth, and intrusted to a competent assistant, who should hold it carefully in position.*

With the gag in position, the index finger of the left hand is carried over the base of the tongue behind the epiglottis to the opening of the larynx. At this point great difficulty is sometimes experienced in recognizing the epiglottis, which in young children is so soft that it can hardly be felt, though in patients over three years of age there is usually no difficulty. In very young patients the larynx is so small and soft that its outlines are indistinct to the tactile sense. To me it feels much like the end of my ring finger. I avoid trouble with the epiglottis by carrying my finger first behind the arytenoids and then slightly forward. With the finger resting on the larynx, the tube is glided quickly along the palmar surface until its end is lodged in the larynx; it is then gently forced through the glottis until its head rests upon the ventricular bands, where it is held by the index finger of the left hand while the applicator with the obturator is disengaged and withdrawn. If any difficulty is experienced in introducing the tube, the instrument should be withdrawn after a few seconds to allow the child to catch its breath; then the attempt may be repeated. The double thread attached to

* The gag which goes with this set is too small, and, unless very carefully watched, is liable to become displaced, so that the operator may be bitten. A friend of mine lost his life the past winter from diphtheria caused by a bite which occurred in this way.

I have used latterly Goodwillie's gag, which is easily retained in position; but, as an additional precaution, I usually use a broad steel band on the first finger.

the tube before its introduction is allowed to remain for a few minutes until the child has partially cleared the trachea, and respiration has become fairly easy. Then the index finger of the left hand is again introduced for a moment upon the head of the tube, and the thread is cut and withdrawn. The whole time occupied after the gag is in position until the tube is safely lodged in the larynx is seldom more than a minute. Within five or ten minutes more the patient is usually breathing with perfect ease, and falls into a quiet sleep. No anæsthetic is used, and little if any pain is complained of by the patient. Subsequently the child requires no more than the ordinary care for a patient with the same malady who had not required surgical interference, excepting as to nourishment.

The patients should be fed on soft solids, and I believe that fluids must be absolutely forbidden, excepting by enemata. Most of these patients might swallow half a drachm of liquid without harm, if at the time they were always careful to bend the head well forward and a little to one side, with the chin pressed firmly against the neck. Some will swallow without any difficulty even without this precaution, and others will swallow readily a part of the time; however, the entrance of a small amount of fluid into the trachea may be sufficient to excite a fatal bronchitis or pneumonia. The best plan is to forbid the use of fluids entirely, for the child on the second day will beg so for water that the attendants are nearly sure to give it unless they have been told that it will kill the patient. After the second day the thirst seems to be much less troublesome. At the time, this direction seems almost cruel, but there is some reason to believe that withholding fluids has a decided effect in limiting the amount of diphtheritic deposit in the air-passages, as well as preventing the excitation of bronchitis or pneumonia. At most, the suffering of the patient can not be long, and, in view of the evils to be avoided, I hope those who use intubation will bear in mind the danger from the ingestion of fluids.

The tube in the larynx is cleared by the ordinary respiratory efforts, or, if it becomes clogged, it will usually be coughed out. Not infrequently it will be coughed out during the course of the treatment; but this does not occur in more than one fourth of the cases, and then it is not apt to be more than once. The largest tube that can be used is most likely to be retained. After from four to six days in many favorable cases, the swelling and false membrane will have so much diminished that the tube may be coughed out finally, and need not be reintroduced. If not expelled, it is removed with

the instrument designed for the purpose. In removing the tube, the gag should be inserted, and the extractor guided into the tube by the finger of the left hand, when, by opening its blades, the tube is caught and may be extracted. If at the same time the trachea is grasped just below the cricoid cartilage and crowded slightly upward and backward, the liability of forcing the tube into the trachea is diminished. Dr. F. E. Waxham, of Chicago, who, I think, was first after O'Dwyer to adopt this method of relieving the dyspnœa of pseudo-membranous laryngitis, has, I think, done more than any one else, excepting the originator, to popularize this operation. He has experimented quite extensively with tubes of various forms. Recently he had constructed tubes with a very small head, and a rubber collar, fitted with an artificial rubber epiglottis, designed to prevent the entrance of foreign substances into the air-passages during deglutition. He has used these with fair success, but has not yet overcome this objection to intubation.

Dr. A. E. Hoadley, also of Chicago, by accident introduced one of O'Dwyer's tubes wrong end foremost, and the patient did well for a time. Subsequently he and others employed this method of seating the tube. It was maintained that, instead of resting with its head on the ventricular bands, it could thus be crowded down so that it rested on the true cords, where it did not so much interfere with closure of the epiglottis, and therefore deglutition was more easily accomplished. Cases treated in this way did just about as well as those treated by O'Dwyer's method, I think, neither better nor worse.

Dr. Hoadley has had tubes constructed much shorter than O'Dwyer's, and with somewhat modified heads, designed to rest on the true cords. He thinks they will be more satisfactory than the longer tubes, but he has not used them. None of these are very different from some of O'Dwyer's patterns. Dr. J. Tascher, an eclectic physician of Chicago, has recently been experimenting with a short tube quite different from O'Dwyer's, with which he has had good success, having treated six patients, of whom three recovered, though in one of these the lower end of the tube became filled with false membrane, and the child nearly suffocated before it could be removed. It will be remembered that it was the liability to this accident which caused Dr. O'Dwyer to adopt the long tube. Dr. Tascher's tubes are made of German silver and are very light, with a comparatively large caliber. There are six in a set, varying in length from $\frac{3}{4}$ to $1\frac{1}{4}$ inch. They are of uniform size from the slight

collar which forms the head to the lower end, and have no bulging upon the side to secure more perfect retention, which he maintains is unnecessary, on account of the position which the head occupies below the ventricular bands. These tubes are flattened at the sides and have an oval aperture measuring from $\frac{1}{8}$ by $\frac{1}{4}$ inch to $\frac{1}{4}$ by $\frac{3}{8}$ inch. The collar which forms the head is only about $\frac{1}{16}$ of an inch in width. The outer edge of its lower surface, which is designed to rest directly upon the vocal cords, projects a trifle below its attached border to prevent it from slipping off the cords.

On a wet preparation of a child's larynx it has been demonstrated that this collar catches so firmly on the vocal cords that the tube can not be forced into the trachea even by using considerable force.

While this is true with this particular larynx, and although the doctor states that there is no danger whatever that the tube will be crowded into the trachea, there remains a fear that this accident may occur at times, and this fear becomes the more real from a knowledge of the fact that, at least in one case,* even O'Dwyer's tube, with its large head, has been crowded down into the trachea and caused death. With the small tubes of Dr. Tascher's it would seem that, even if they were crowded into the trachea, they would not greatly obstruct it and might be easily removed by tracheotomy, or possibly with a long tracheal forceps. The advantages of these small tubes, if they were only longer, are at once apparent, if it is a fact that there is no danger of their passing into the trachea. They are small and light, and may be so deeply seated that they do not greatly interfere with deglutition; but it remains to be seen whether they are more likely to cause ulceration of the vocal cords, and whether subsequent cases will average better than those treated by O'Dwyer's tubes. These, like the other modifications of the laryngeal tube, are introduced and removed with Dr. O'Dwyer's instruments.

I have treated twelve cases of diphtheritic laryngitis by intubation, none of which occurred in my own practice. In only three of these cases had I the subsequent care of the patient, and by a strange coincidence these were the only ones that recovered; however, one other lived for eight days and then died suddenly, an hour after the

* It is hardly necessary to state that this case has not been reported. The knowledge of it came to me through a physician for whom I had performed intubation. He told me that the child had recovered from diphtheria, and that, on attempting to remove the tube, the accident occurred with the result stated.

tube had been removed, either of paralysis or of spasm; and another lived eight days, but then died of pneumonia said to have resulted from exposure after the tube had been removed.

Of these cases, Nos. I to V, inclusive, have been reported elsewhere, but, as two of them illustrate what I wish to say of treatment, I shall be obliged to give abstracts of them here.

Case I.—Consultation with Dr. A. M. Stout. A little girl two years of age. Diphtheritic laryngitis, with great lividity, dyspnœa, and stridor. Intubation; immediate relief. Death from constitutional results of diphtheria forty hours later.

Case II.—Consultation with Dr. J. F. Todd. A strong boy five years of age. This was termed membranous croup. There was considerable lividity of the lips, with recession of the chest-walls during inspiration. Intubation; complete relief of dyspnœa. The patient did well for about twenty hours. Bronchitis then developed, and the child died about thirty-nine hours after the operation.

Case III.—Consultation with Dr. C. J. Creighton. A girl five and a half years of age. Diphtheritic laryngitis, with great dyspnœa. Intubation; complete relief, but death from bronchitis in thirty-six hours.

Case IV.—Consultation with Dr. E. Garrott. Girl four years of age. Diphtheritic laryngitis, but no membrane in the fauces. Great difficulty in respiration, with recession of chest-walls. Intubation. Very soon after the tube was introduced the child coughed up a large piece of false membrane, after which dyspnœa was entirely relieved. Prescribed the mild chloride of mercury, gr. $\frac{1}{2}$ to gr. j, every two or three hours. Directed that soft solids be given, but fluids withheld as far as possible. Ice was allowed freely. A little water and milk were given this patient, but she soon learned to swallow half a teaspoonful at a time, when lying on the side, without cough, which would have occurred if it had entered the trachea. However, before this, fluids had been frequently taken which had caused paroxysm of cough. Bronchitis developed, and the second or third day after the intubation there was high fever with numerous mucous râles over the entire chest. The mild chloride was continued during this time, and in addition tincture nux vomica and carbonate of ammonium, with syrup of ipecac, were given. The fourth day the patient was better. During the latter part of this day the patient managed to get the tube out without cough, but it was not necessary to reinsert it. She made a rapid and complete recovery.

Case V.—Dr. Lilly's patient, a girl, aged four years and eight months. Diphtheritic laryngitis, lividity, great dyspnœa, and recession of chest-walls. Intubation, with immediate relief. I directed that the child should be fed on soft solids and allowed to suck bits of ice, but that very little fluid be given, and this never in greater quantities than half a teaspoonful. Unfortunately, these directions were not carried out thor-

oughly, but considerable fluid was given, each draught of which caused severe cough, showing that more or less of it went into the trachea. Twenty hours after the tube was introduced I found the temperature 104·8°, patient extremely restless, face becoming livid, pulse irregular, rapid, and feeble, urine scanty, and respiration sighing and imperfect. All over the chest were numerous sonorous and sibilant râles; indeed, the patient presented all the symptoms of the last stage of diphtheritic bronchitis. Such symptoms I have often seen, but have never before seen the patient survive more than two or three hours. When the child was first seen I had ordered hydrarg. chlor. mite in doses of two grains every two hours, which was still continued; but at this time I ordered tinct. nucis vom., ℥j; amm. carb., gr. j; syr. ipecac, ℥ xij; and potass. acetat., gr. iv, in syrup of licorice, to be given every two hours alternately with the mild chloride. The following morning the patient had slightly improved, the temperature being only 104°. I then discontinued the mild chloride and ordered the above-mentioned remedies to be given every hour. The relief was most marked, and I have no doubt that the comparatively large and frequently repeated doses of the cardiac and respiratory stimulants saved the child's life. The tube was coughed out and reinserted on the second day, and was again coughed out on the fourth day, but was not needed subsequently. The child recovered slowly, and it was three or four weeks before the signs of laryngitis and bronchitis had entirely disappeared.

Case VI.—Seen in consultation with Dr. B. A little girl, two and a half years of age, suffering with diphtheritic laryngitis; serious dyspnœa, with recession of chest-walls during each inspiration. Introduction of the laryngeal tube gave immediate relief, but she died about twenty-four hours later with symptoms of diphtheritic bronchitis.

Case VII.—Consultation with Dr. R. J. Price. Girl, two and a half years of age, suffering from diphtheritic laryngitis, there being no membrane in the fauces. There was great dyspnœa, which must have terminated fatally in a few hours but for the operation. Intubation; perfect relief. Patient did well for six days. Seventh day, peevish and irritable, and looking poorly. The eighth day, better. The attending physician removed the tube, and after half an hour, during which time respiration had been natural, he left the patient. He was called back in about half an hour, and found the child dying, but could not determine the cause. However, he opened the trachea, but without avail.

The cause of death in this case was inexplicable, but it seemed to have been much the same as that in two cases reported to me by Dr. O'Shea, and one of which I had verbal reports from Dr. Waxham. At the time I thought it to have been heart failure. Dr. O'Shea attributed the death in his cases to spasm. Dr. Waxham could not account for the one of which he told me, but thought it

must have been from occlusion of the glottis by partially loosened membrane. It is probable that laryngeal paralysis or spasm was the cause of the fatal termination of these cases, for it is not likely that cardiac failure would have happened to occur at that particular time —half an hour to an hour after removal of the tube—when there had been no evidence of it immediately before.

Case VIII.—Consultation with Dr. G. V. Bachelle. A girl seven years of age had been suffering from diphtheritic croup for five days, and at the time of operation was livid and laboring for breath, with marked recession of the chest-walls. Intubation; complete relief; did well for six days, when the tube was removed. The parents were very careless, and allowed the child to expose herself shortly afterward, whereby she contracted a pneumonia from which she died three days later.

This case I have not counted among the recoveries, though, so far as the operation was concerned, it was entirely successful.

Case IX.—Consultation with Dr. F. A. Lilly. Boy aged four years and four months. Diphtheritic laryngitis of severe form, severe dyspnœa, the child having already passed into that listless stage which precedes a fatal termination. Intubation; great relief, but the child was so low as to be unable to cough up the mucus from the trachea. Death in twenty hours.

Case X.—Consultation with Dr. C. J. Creighton. Boy aged four years and three months. Child in almost exactly the same condition as that in the preceding case. Intubation; complete relief from dyspnœa, but the child died in about twenty-one hours.

Case XI.—Consultation with Dr. B. Girl aged three and a half years, Diphtheritic laryngitis, urgent dyspnœa, and impending death. Intubation; perfect relief. In this case the child ceased to breathe before the tube was inserted, but it was introduced quickly and artificial respiration was instituted, whereby the patient was resuscitated. Here I had urged the necessity of withholding all fluids, but about fifteen hours after the tube had been inserted I was told that the child had learned to swallow easily, though how long it had been practicing with fluids was not stated. I at once mentally affixed to its record the word dead. The patient died at the end of about twenty-four hours of diphtheritic bronchitis.

Case XII.—Consultation with Dr. P. Matthei. Boy aged four years. Had been sick five days. Diphtheritic laryngitis, with labored respiration and recession of the chest-walls. Intubation; perfect relief of dyspnœa, and the child, as usual in such cases, soon fell into a quiet sleep. Directed that soft solids be given and ice to quench thirst, but forbade a drop of fluid in any other way. Ordered hydrarg. chlor. mite, gr. j, every hour. The next morning (twenty-four hours later) pulse 132, temperature 100°, a little cough, and easy expectoration, but no signs of bronchitis. The

child was now begging for water, but I impressed the friends with the danger, and water was still forbidden excepting by enemata. The child was very restless during the day, apparently on account of thirst, and begged piteously for water, milk, wine, beer, or anything that it might drink. The friends thought he was becoming delirious for want of water. Fearing they would yield, I told them that they would kill the child if they gave it anything to drink. Even the physician, kind-hearted man that he is, interceded in behalf of the child, but I was so strongly impressed with the necessity for the measure that I still firmly refused; and, as the family had just lost one little one from diphtheritic laryngitis after tracheotomy, they were sufficiently frightened to follow my orders, excepting that they gave fluids *per rectum* but once. The second day the pulse was 130, respiration 28, temperature 99·5°. The child had rested quietly through the night and asked very little for water. The mild chloride was now given less frequently—only once in four hours—and alternately with it a grain of quinine. No râles over the chest. The morning of the third day pulse 136, respiration 24, temperature 98°. The patient had rested well, but had eaten little since the operation, and had had only two nutritive enemata during the whole time, instead of three or four daily, as had been ordered. A very few bronchial râles could be heard at this time. The child had ceased to ask for water. Early the following morning (fourth day), with a slight cough the tube was expelled. Breathing remained easy, so that it was not necessary to reintroduce the tube. Pulse 132, temperature 96·2°. After the tube had been removed milk was given, but some of it found its way into the trachea and excited cough. However, very little trouble was subsequently experienced from this source, and the child made a complete recovery.

Of these cases, those numbered IV, V, and XII indicate the course of treatment which I believe to be most efficient after intubation for diphtheritic laryngitis: 1. Prohibit all fluids excepting by enemata, and insist upon this so forcibly that your orders will be obeyed. 2. As another safeguard, give some preparation of mercury in comparatively large and in frequent doses. 3. In case of the development of bronchitis or pneumonia, give respiratory and cardiac stimulants freely but judiciously.

In Case IV my directions were followed very well, but I allowed water or milk to be given in small quantities, hence the bronchitis.

In Case V fluids were given far too freely, hence the bare escape from death.

In Case XII I told the friends they would kill the child if they gave a teaspoonful of fluid, hence the recovery with but little bronchitis. There may be too small ground for these conclusions, but I

am fully convinced of the necessity of withholding fluids excepting when given in such manner that they can not possibly enter the larynx.

There is an old and, it is said, very efficient treatment for acute laryngo-tracheitis and bronchitis, which consists of simply withholding all fluids for forty-eight hours. This gives color to the hypothesis that, after intubation for diphtheritic cases, this method not only avoids the danger of exciting inflammation, but actually aids in curing that which already exists.

Most valuable and interesting articles on this subject have been written by Dr. O'Dwyer, Dr. Waxham, Dr. Northrup, Dr. Hance, Dr. Caillé, and others. From these and from personal letters which these gentlemen have kindly furnished me, I have obtained reports of over five hundred cases. Briefly, these reports are as follows:

Dr. S. A. McWilliams, of Chicago, reports three cases, one of them in a child under three years of age—all of diphtheritic croup. The tube was worn in them from one half to forty-eight hours. There were no recoveries. The immediate effect of intubation was excellent. In two cases the tube was coughed out, and the parents refused to have it reintroduced.

Dr. William Cheatham, of Louisville, Ky., writes me that he has had fifteen cases of intubation, ten of them in patients under three years of age. Tubes were worn from eighteen hours to four days. There was immediate relief, except in one case. This latter patient was found pulseless; when seen, the tube was introduced, brandy was injected hypodermically, artificial respiration was resorted to, and in half an hour the child was breathing well again. It died in twenty-four hours from heart-failure. There was one recovery among his cases. The doctor says he will never do another tracheotomy for croup, and believes intubation is far better. A majority of his patients died from extension of the membrane, others from heart-failure and asthenia.

Dr. George W. Mason, of Bloomington, Ill., reports three cases, all in patients over three years of age. One case he terms diphtheritic croup, and the others membranous croup. There was relief to respiration in all. The tubes were worn from one to one hundred and twenty hours. There was one recovery. The third patient died from complication of whooping-cough and pneumonia.

Dr. Homer O. Bates, of Chicago, reports six cases, two of them in children under three years of age. All suffered from diphtheritic croup. The tube was worn from one hour in one case to four days and four hours in another. The relief was immediate. There were three recoveries. Dr. Bates believes intubation a valuable means of relief, and in proper cases the best treatment, but that it can not supplant tracheotomy in all

cases. The youngest patient that recovered was eight and a half months old. This patient came near dying from diphtheritic bronchitis, but was finally relieved by the same prescription that I had given in one of my successful cases (No. 5).

Dr. F. Henrotin, of Chicago, reports nine cases, two of them in children under three years of age. These patients were suffering from croup, all but two showing more or less diphtheritic membrane in the fauces. The tube was worn from three to six days. In two cases no relief was given by the operation; in one only partial relief, and in the others there was complete relief from stenosis, and disappearance of its symptoms. He had three recoveries.

Dr. J. L. Mulfinger, of Chicago, reports two cases, one patient being eight, the other five years old, both suffering from diphtheria. One had relief almost at once, and recovered. The other had very little relief, even temporarily, and died in about twelve hours. In the one that recovered there was complete loss of voice for seven days after the tube was removed, and more or less aphonia continued for two months.

Dr. Hopkins, of Buffalo, reported six cases in which impending death was overcome, and life saved by intubation.

Dr. Hailes, of Albany, N. Y., reported two cases in which intubation was successfully practiced.

Dr. John B. Wheeler, of Burlington, Vt., reports the case of a child three and a half years old. There was improvement at once, but the tube became plugged with a large piece of membrane, and the child choked and died in about two minutes. The tube was retained about fourteen hours.

Dr. E. D. Ferguson, of Troy, N. Y., reports one case, in a child three years old, suffering from diphtheria. When the obturator was withdrawn, respiration was stopped completely, and tracheotomy became necessary. The child died in about thirty hours. False membrane had probably occluded the lower end of the tube.

Dr. Charles Denison, of Denver, Col., reports one case of diphtheritic laryngitis in a child six years old. On introduction, the tube displaced some membrane, and the tube and membrane were immediately ejected, and it was not necessary to reintroduce it. The child was laboring for breath, with its lips purple and its face suffused before the intubation.

Dr. F. Tipton, of Selma, Ala., reports one case in a child four years old suffering from diphtheria. The tube remained in position fourteen days. There was immediate relief, and the child recovered. The same physician reports that one tube went into the stomach, but was passed in ten days without ill effects.

Dr. L. H. Dunning, of South Bend, Ind., reports seven cases, four of them in children under three years of age. Two of them were for diphtheritic croup, five for pseudo-membranous croup. The tube was worn from twelve to one hundred and twelve hours. In five cases there was almost immediate relief. In one case there was relief after reintroduction

of the tube. In another case the patient had a violent struggle after the tube was placed, and finally, when death seemed imminent, a pseudo-membranous cast of the larynx and trachea, one inch and a half long, was forcibly ejected from the mouth. This patient made a speedy recovery. The doctor is enthusiastically in favor of the operation, which he thinks simpler than catheterization of the bladder.

Dr. Irwin H. Hance, of New York, informs me that he has had six cases of intubation, all in children under three years of age, four cases of diphtheria, one of which was complicated with scarlet fever, one case of diphtheritic laryngitis, one case of catarrhal croup with extensive bronchitis. The tube was worn from six hours to five days and a quarter. This latter patient recovered; the remaining five died. In five cases there was immediate relief; in one case no relief until after laryngotomy had been performed. In this last-named case there was no relief while the tube was in place. It was placed in the larynx five times, and remained once for twenty-five minutes, without diminution of the severity of the dyspnœa, which was more severe while the tube was *in situ*.

Dr. Montgomery, of Philadelphia, reports thirteen cases. In no case did death occur in less than twenty-four hours, and the relief from dyspnœa was prompt in every case. Six of his patients recovered. The youngest child, eighteen months old, died on the fifth day in convulsions. The youngest child to recover was two years old. In one case the tube was coughed up and swallowed. It was passed *per anum* two days later with no ill effects.

Dr. A. E. Hoadley, of Chicago, reports nine cases, two of them in children under three years of age. All had diphtheria. The tube was worn from twelve hours to four days. The operation afforded complete relief from the difficult breathing, but there were no recoveries. One of the patients died from pneumonia, one from extension of the membrane into the finer tubes, and seven from the constitutional effects of the disease. He prefers the deep position of the tube.

Dr. J. Tascher, of Chicago, reports eleven cases, three of them in children under three years of age. The tube was worn from eight to seventy-two hours. He says there was immediate relief in every case. He had four recoveries. Four of the deaths were from broncho-pneumonia, one from occlusion of the tube by a large piece of membrane, two from blood poisoning. On six of the patients he used the short tube with small head, already described, and of these three recovered. He states that none of these six patients had much difficulty in swallowing.

Dr. D. O'Shea, of Chicago, reports thirty-seven cases, eight of them in children under three years of age. These patients had diphtheritic laryngitis. The tube was worn for periods varying from six hours to eleven days. He reports fourteen recoveries. In two cases patients had spasmodic action of the larynx after the tube was coughed out, and died in a few minutes.

Dr. A. B. Strong, of Chicago, reports thirty-one cases, eight in children

under three years of age. All these had membranous obstruction of the larynx. The tube was worn from a few hours to seven days. The patients had immediate relief in every instance. There was one recovery. The remainder died the second or third day, usually from bronchitis. He objects to the operation for the reason that patients can not eat with the tube in position.

Dr. F. C. Schaefer, of Chicago, reports four cases. Two of the patients were under three years of age. The tube was worn from one hour to two days. All had diphtheria. There was great relief in all cases except the last one, in which a short tube was used. This child had pneumonia at the time, and there was but slight relief. He had no recoveries. In one case tracheotomy was performed twenty-four hours after intubation, and the child lived thirty hours after the operation.

Dr. A. Caillé, of New York, writes me that he has operated in twelve cases, seven of them in children under three years of age. Seven of these had pharyngeal diphtheria with laryngeal stenosis, four had true membranous laryngitis, and one had urgent stenosis of five days' standing. The tube was worn from four hours to fourteen days. The result was very satisfactory in every case. He had five recoveries. The doctor says he finds that solid food chopped fine and moistened is swallowed fairly well. In addition he gives ice, and stimulates *per rectum*. He gives mercury through the cutis by means of lanolin. He has done tracheotomy twenty-one times with only five recoveries, and says that in the majority of cases he shall intubate. In certain cases of septic diphtheria with stenosis, where proper and sufficient nourishment and stimulation were a *sine qua non*, he might prefer tracheotomy. Recently he has been in the habit of removing the tube after twelve, twenty-four, or thirty-six hours, if the patient does not get enough nourishment, and then, after giving food, medicine, or stimulants by the mouth, he reintroduces it if necessary, repeating this process several times as needed. He gives finely divided solid food moistened with water and no liquids, and says his results have been better since he has followed this plan.

Dr. C. E. Denhard, of New York, writes me that he has operated on twenty-four patients with diphtheria, seventeen of them under three years of age. The tube was worn from two to eleven days. In every instance there was immediate relief. There were ten recoveries. He says that out of thirty-four cases of tracheotomy he had fifteen recoveries. All who recovered were over three years of age, excepting two, aged two and two and a half respectively.

Dr. W. P. Northrup, of New York, writes me that he has operated on thirty patients with six recoveries. Twelve of his patients were under three years of age. The tube was worn from two hours to seven days. In every case but one there was effectual prompt relief. In that exceptional case the patient died two hours after the intubation from extension of the diphtheritic process. All the patients had albuminuria and diphtheria of the pharynx. Two died from heart-failure while apparently

doing well. He has never had the slightest accident attributable to the tube, but has found, in the course of his autopsies at the asylum, two ulcers at the lower end of the tube where it rubbed against the anterior surface of the trachea; but he is uncertain whether or not there were defects in the tube to account for the irritation.

Dr. Northrup says his predecessor put a tube into the stomach by mistake. It passed in fifty-two hours unaided and without symptoms.

Dr. Joseph O'Dwyer informs me by letter that he has operated in one hundred and thirty-seven cases of croup since the beginning of his experiments in 1880. Of these he reports twenty-seven recoveries; but he adds that a large number of them were experimental cases before the instruments had been perfected. The average time during which the tube was worn in eighteen cases of recovery was four days and twenty-two hours.

Dr. F. E. Waxham, of Chicago, in addition to the eighty-three cases already reported with twenty-three recoveries, tells me that he has had forty-eight additional cases with eleven recoveries, making one hundred and thirty-one cases with thirty-four recoveries. The youngest child to recover was nine months of age, the oldest nine years. He believes the percentage of recoveries under three years better than after tracheotomy, but for patients over three years the percentage after tracheotomy seems a little better than after intubation. He adds that all the cases operated on were desperate, many of the patients being moribund at the time, and that in no case was the tube introduced until the dyspnœa had become urgent.

Thus, altogether, I have reports of 514 cases, in 134 of which, or $26\frac{1}{100}$ per cent., the patients have recovered. Of these, many were under three years of age, and a number of them recovered. Dr. Waxham states that of fifty-two patients under three years of age, 25 per cent. had recovered. This is certainly a remarkably good showing, for of children under four years in whom tracheotomy has been done for diphtheritic laryngitis, the statements of different authors, though varying widely, seem to prove that not more than 15 or 20 per cent. recover. The statistics of tracheotomy in the same disease for all ages show that from 25 to 70 per cent. recover, but very great disparity will be noted in the results of individual operators. That this disparity is partially due to the operation itself is possibly true, though this I believe is the least of the factors. Much, however, does depend on the judgment of the operator in determining the time for the operation, and on his personal influence in securing the consent of the parents early; much on the amount of care exercised by him in operating only on patients who are likely to recover, and on the subsequent care of the patient; but, most of all,

the results will be modified by the epidemic influences and immediate surroundings of the case. It has been found that under the same circumstances as to operator, general surroundings, and treatment, the death-rate will vary greatly in different epidemics.

The same might be said of intubation of the larynx; but in estimating the value of the new procedure we must not forget that, in probably less than 10 per cent. of the cases that have been treated by it, it would have been impossible to obtain the consent of the parents to tracheotomy, and therefore most of those that have recovered must have perished but for the new method.

Remembering that in the fatal cases many have died of bronchitis or pneumonia, which may have been caused by foreign substances in the air-passages, and considering the satisfactory results in the few cases in which fluids have been withheld while the tube was in the larynx, I feel confident that the percentage of recoveries from this method will be much greater when more care is exercised in this respect.

When medicines fail to relieve pseudo-membranous laryngitis, no time should be lost in providing for the free entrance of air, and for this purpose either intubation of the larynx or tracheotomy should be resorted to. The former may be done more quickly and safely and with less shock to the patient, and with less objection from friends; therefore it should be tried first, unless there is serious obstruction in the fauces or trachea; but the operator should always be prepared to open the trachea in case loosened membrane should be forced down by the laryngeal tube. Tracheotomy should also be practiced in cases where the laryngeal tube from any cause fails to relieve the dyspnœa, unless we have sufficient reason to believe that this operation would also fail. In cases where the operator believes that false membrane is loose in the trachea, no time should be wasted by attempting to remove it with a forceps, for, though this attempt may occasionally be successful, it is much more likely to fail, and then a death will result which might have been averted by tracheotomy. If, however, it is thought best to introduce a forceps into the trachea, Mackenzie's long laryngeal forceps opening anteroposteriorly will be found the best.

While intubation can not always take the place of tracheotomy, it has much to recommend it in the majority of cases. In conclusion, I wish to state again what has already been said:

1. Intubation may be quickly and easily performed, and with but little danger.

2. Friends readily consent to the procedure.

3. There is no necessity of tedious after-treatment, as the tube is kept clear by the respiratory efforts.

4. The results so far are practically as good as those of tracheotomy at all ages, and apparently better in very young children.

5. To secure the best results, great care must be taken to prevent the entrance of foreign substances into the trachea.

6. At present, with O'Dwyer's tubes, the most successful plan is to absolutely prohibit the deglutition of fluids while the tube remains in the larynx. Small bits of ice may be sucked to allay thirst; soft solids may be swallowed, and fluids may, if necessary, be supplied by enemata, or the tube may be removed to feed the patient, and then be reintroduced.

7. Tubes with smaller heads, designed to rest on the vocal cords, have not yet been used sufficiently often to enable us to speak positively about them. If experience proves that they do not often slip into the trachea, and that they do not injure the vocal cords, they will be especially useful, for they will nearly overcome the difficulty in deglutition, and patients wearing them may eat and drink at pleasure, excepting when paralysis or some other result of the disease prevents closure of the epiglottis.

8. Medical treatment should be carefully attended to after intubation, and we must spare no effort to prevent extension of the disease to the bronchial tubes, or to relieve the dyspnœa which it occasions. I apprehend that successful after-treatment depends largely upon the judicious and timely use of suitable expectorants and respiratory and cardiac stimulants.

9. Though short tubes may be used with good results in some cases, the danger of their becoming filled with pseudo-membrane is so great as to render long tubes preferable.

10. Intubation may and should be practiced early, and it does not preclude subsequent tracheotomy.

11. For serious cases of spasmodic croup, and for œdema of the glottis, this will prove a most useful procedure. Lastly,

12. For the treatment of chronic laryngeal stenosis this method will, doubtless, be of value.

For many months this new operation received somewhat more of praise than it deserved, but already it is receiving unjust criticisms, which may possibly more than offset the praise; but ere long it will find its proper place among the measures for relieving suffering and prolonging human life, and by and by a multitude of those who have

been saved by intubation will rise to thank not only its originator, but also the liberal profession which keeps no secrets in the healing art, but freely bestows its blessings on mankind.

Considering what has already been accomplished, we must acknowledge our debt of gratitude to Dr. O'Dwyer for perseverance in perfecting this operation, and for demonstrating its practicability, and we must thank Dr. Waxham and others for their enthusiastic employment of it, which has led so many physicians to test its merits.

Paper.

A STUDY OF THE PRINCIPAL OBJECTIONABLE FEATURES OF INTUBATION.

By CHARLES E. SAJOUS, M. D.

AS the literature of intubation increases, a firm believer in its many advantages can not but behold with regret the statistical evidence which, although numerically increasing daily, does not improve its relative position as regards its powerful opponent, tracheotomy. This is certainly a source of sorrow to the physician who has had repeatedly to witness the mental agony of fond parents, for he hailed intubation as at least a substitute to the ever-dreaded knife —a substitute entailing less physical suffering upon the patient, less mental suffering upon the relatives. These advantages not only implied greater liberty of action, but less hesitation, less delay, not uncommon causes of a fatal issue.

The proportion of recoveries after tracheotomy, according to Agnew, who based his calculations upon ten thousand cases, is about 30 per cent. In intubation, a list of three hundred and fifteen cases, computed by myself, showed that only $25\frac{1}{10}$ per cent. were successful —a difference of $4\frac{9}{10}$ per cent. in favor of tracheotomy. It does not compete with the latter, therefore, but stands second to it, to be resorted to when the former is not permitted. This secondary position it has about held for the past year, and since, as time advances, there does not seem to be an increase in the proportionate number of recoveries, the profession is gradually becoming accustomed to intubation in the light of an easier, but less promising, operation than tracheotomy.

O'Dwyer's contribution to practical medicine is worthy of a higher standard. Its inherent qualities are too numerous not to

raise it ultimately to the first rank. Had Bouchut been able to present even the bare 25 per cent. of recoveries, and "tubage" received since then the attention that tracheotomy has received, and consequently reached the perfection that the latter has, the question of comparison would not to-day present itself. Tracheotomy would not only be secondary to intubation in the sense here understood, but it would be limited entirely to different classes of cases. As it stands to-day, intubation is encumbered in its progress by not a few real defects. Analyzing these, and studying their cause, will, I am sure, lead to their early correction, and soon annul the dangers resulting from them. In presenting this paper I merely wish to record the result of a little thinking, and in doing so it is my humble desire merely to suggest a plan of action that will, in my opinion, soonest bring about the desired result. In this I feel that I am morally supported by Dr. O'Dwyer; and, if I differ with him in several emitted opinions and herein present them without reserve, he will, I hope, bear in mind that I am one of his warmest admirers.

I am confident of the ultimate success and of the greater ultimate comparative value of intubation over tracheotomy, because I am of the opinion that the difficulties militating against the former are purely mechanical; while a close study of these mechanical defects has led me to believe that they are in turn due to erroneous conclusions as to the relative action of several prominent factors in the general plan of procedure.

Taking the principal objections to intubation, and arranging them according to the degree of danger attending them, we have:

1. Obstruction of the tube by fragments of membrane.

2. Crowding down of loose membrane during introduction of the tube.

3. Passage of food through the tube into the trachea, and consequent inability to feed sufficiently through the mouth.

4. Momentary arrest of respiration during introduction, and shock resulting therefrom.

5. Liability of the tube to be coughed out, and slipping of the tube into the trachea.

1. *Obstruction of the Tube by Fragments of Membrane.*—This defect I believe to be due (1) to the limited diameter of the interior of the tube; (2) to its internal conformation.

As to the first defect, Dr. O'Dwyer considers a limited diameter of the tube necessary to preserve the expulsive force of cough in

the expulsion of detached pseudo-membrane. To use his words: "Cough, to have its full expulsive power, requires a full inspiration, complete closure of the glottis, and then a violent expiratory effort, which compresses the air in the lungs, and forces it through the small space between the still contracted vocal cord. Coughing through a tube, on the contrary, whether in the larynx or trachea, means inability to close the glottis, with little power of compressing the air, and, consequently, little expulsive power. Therefore, the smaller the tube, compatible with free respiration, the better, as there will be more power to expectorate, and less accumulation of secretions in the air-passages, which predisposes to the development of bronchial catarrh and broncho-pneumonia." I can not agree with him in this opinion. The tube hanging loosely in the cavity of the trachea, and the head only closing the laryngeal aperture by its weight, it seems to me that the smaller the interior of the tube, the smaller the tube proper, and the more chance for the expulsive air-current of the cough to force itself out *around* the tube, between tissues too much swollen to render respiration between them possible, but still not resisting enough not to separate under the pressure of the air-column. The force exerted upon the membrane choking the tube depends, therefore, upon the amount of resistance the tissues surrounding the tube present to the passage of the air-current; if that resistance is great, and the membrane not too tightly wedged in the cavity, the fragment will be coughed out; if the surrounding tissues and the impacted membrane present more resistance than the air-current is able to overcome, the tube will be coughed out, if the latter is held loosely; if, on the contrary, the tube is too tightly held to be coughed out, asphyxia ensues. Here a defect becomes a virtue, and I do not think that I am mistaken in saying that loose tubes have saved many lives.

Close apposition of the vocal bands is only necessary to the expulsion of very small masses. We all know the power of the voiceless "hem" to bring up even quite small quantities of mucus, and the violence with which this movement sometimes causes small particles of mucus to fly out through the mouth. In the execution of this movement, the vocal bands remain quite a distance apart. Bouchut states that in one of his cases great cyanosis existed, and that this was relieved by the ejection of false membrane through his tube. In a second case, the introduction of the tube was followed by the expulsion, at two different times, of *casts* of the primary bronchus. Bouchut's tubes were large. Have we not here practical

evidence that a narrow aperture is *not* necessary for the proper expulsion of the pseudo-membrane?

For the proper expulsion of loose membrane from any part of the trachea, the power of the air-current must exert itself equally upon all parts of the cavity, in order that every part of it be impinged upon by the mechanical pressure that the air-current affords. In order to obtain the greatest advantage from this force, the upper opening of the trachea must approximate as much as possible its general diameter, including that of the portion immediately above the bifurcation. If the upper orifice is constricted, the expulsive force centers itself there, and exerts no influence upon the pseudo-membrane. At the same time, only a part of the air-current passes out, while a part recoils, to counteract, to a degree, the expulsive force. A natural indication resulting from this argument would be to use a laryngeal tube approaching as nearly as possible the diameter of the normal larynx. I can not agree, therefore, with Dr. O'Dwyer, who says: "The smaller the tube compatible with free respiration, the better, as there will be more power to expectorate and less accumulation in the air-passages, which predisposes to bronchial catarrh and bronchopneumonia."

2. *Crowding down of Detached False Membrane during the Introduction of the Tube.*—This accident has occurred a sufficient number of times to render it worthy of a prominent position in the list of dangers accompanying the operation. I believe it to be due principally to the length of the tubes. "The object of having them so long," says Dr. O'Dwyer, "is to retain the pseudo-membrane *in situ* as it becomes detached from the tracheal walls until maceration takes place." I am inclined to consider this as a dangerous measure; it seems to me contrary to all teachings to mechanically retain over their seat of formation masses of an infectious product that serves but to add to the general toxæmia, both through the blood and through the inspired air. As prompt a deliverance of all pseudo-membrane as possible would seem to me more compatible with our efforts to prevent extension to the lungs proper.

This reason, therefore, does not appear to me to hold good in accounting for the inordinate length of the tubes. Their action in crowding down membrane needs no explanation. The deeper the instrument sinks, the more opportunity it has of meeting detached portions which, untouched, would have remained innocuous. This danger, therefore, is proportionate to the length of the tube employed.

3. *Passage of Food through the Tube into the Trachea.*—In considering this drawback, an important question presents itself. Is there not, in the occasional passage of food into the trachea, a prolific cause of broncho-pneumonia, corresponding, at least, with the ætiological position of tracheotomy in relation to that complication? Waxham, of Chicago, one of intubation's warmest advocates, who has probably had more experience than any man living in the performance of that operation, stated at a meeting of the Chicago Medical Society, held on February 7th last, that, "besides the difficulty of swallowing, food and fluids ran into the bronchial tubes through the cannula, and that it was true that many patients died from broncho-pneumonia from this source," * presenting at the same time an ingenious attachment of his invention to overcome the difficulty. Again, to quote his words: "He (the physician) may tell the people to feed it bread and milk, or semi-solids, and, if he investigate the matter, he will find that they are giving it half a teaspoonful of milk with a little bread, *and the milk trickles into the trachea* and the bread is rejected. If they are told to make a custard, they make it so soft and fluid that *it will trickle into the trachea.*" † Imagine a custard and milk rolling down into the trachea! And still I have not the least doubt that Dr. Waxham was perfectly right.

In a list of seventeen observers, it is a rather obvious fact that those who report the greatest number of cases characterized by marked difficulty in swallowing, report at the same time the greatest number of deaths from broncho-pneumonia. This may be a mere coincidence, but I am inclined to believe that it is not.

Fletcher Ingals, in the proceedings of March 7th of the Chicago Medical Society, stated that, in the cases in which he had introduced the tube for other physicians, "those that recovered, he had insisted that they should drink absolutely nothing." In the last case he insisted upon this so strongly that "he cautioned the parents that if they gave the child a teaspoonful of water they would kill it."

That impediment to proper deglutition is an important defect of the operation is demonstrated by the fact that fifteen of the seventeen writers above alluded to mention it in connection with their cases in a more or less emphatic manner.

Dr. O'Dwyer believes this defect to depend principally upon the state of the epiglottis, the mobility of which may be very much crippled by inflammatory thickening. I doubt whether this is the case,

* "Jour. of the Am. Med. Assoc.," March 12, 1887, p. 291.

† "Cincinnati Lancet-Clinic," March 26, 1887.

as the proportion of cases in which the epiglottis is involved in the inflammatory process sufficiently to paralyze its functions is not to be compared with the number of cases in which deglutition becomes difficult. Again, difficulty in swallowing is mentioned as occurring only *after* the introduction of the tube in all the cases reported, a fact demonstrating that the difficulty is due to the presence of the tube.

The prevailing opinion respecting the cause of this objectionable feature is that it is due to the impediment offered by the head of the tube to the free action of the epiglottis, by preventing its close apposition to the upper portion of the larynx. That this is but a small part of the faulty mechanism is shown by the following words of Dr. O'Dwyer: "The heads of my first tubes were made very small, to permit them to sink well down in the larynx, so that the epiglottis could perform its function more perfectly. . . . Notwithstanding that I have quadrupled their size, I *can see no difference in the ability to swallow fluids.*" There must, therefore, be another cause. That cause I am inclined to believe to be the weight of the tube. Elevation of the larynx during the act of deglutition is as important a feature of the proper execution of that act as the contraction of the constrictors. The muscles presiding over this elevation are not strong; their duty being a fixed one, their power is proportionate to the weight that they are calculated to lift. There is, perhaps, a certain amount of latent force in them, to serve in case of necessity, but that latent force can be at its best only during health, and the general stiffness that pervades the entire throat during severe local inflammatory infiltration can but counteract it, to say the least. If we add weight to the burden, the exact power necessary will either be present or absent, according to the inherent strength of the muscles and to the degree of their involvement in the inflammatory process. It must not be forgotten that in swallowing the larynx ascends more toward the epiglottis than the epiglottis descends to the larynx. If, therefore, the ascent of the former is checked by only one sixteenth of an inch, there will be an aperture left quite sufficient to allow a considerable quantity of fluid to enter.

4. *Momentary Arrest of Respiration during the Introduction of the Tube.*—Dr. L. L. Palmer, of Toronto, in an interesting article on intubation,* relates a case in which the introduction of the tube was followed by an increase in the pulse-rate of from fifteen to twenty beats, which continued until death. He recommends a short first

* "Canadian Practitioner," January, 1887.

attempt, with special effort, to render it successful. He is inclined to consider momentary asphyxias as greatly aggravating causes, and is considering whether in his case these did not cause extension of the local manifestations.

Although seldom alluded to, this feature of the operation must certainly carry along with it a pernicious effect upon the already semi-asphyxiated patient. Needless to say that it is due to the presence of the obturator, which blocks up the cavity of the tube from the time the tip enters the larynx until it is well in place.

5. *Liability of the Tube to be coughed out.*—This occurs in almost every case, and is due, in my opinion, to the conformation of the tube, which exposes it to the action of the air-current during cough, and causes it to be influenced by it as if it were a foreign body.

The principal mechanical defect in this case is again the limited diameter of the interior of the tube, which is out of proportion to that of the column of air. The pressure is, therefore, exerted *around* the instrument with sudden violence, assisting the suddenly narrowed portion of the air-current which passes *through* the tube, in lifting it bodily.

6. *Slipping of the Tube into the Trachea.*—Slipping of the tube into the trachea during efforts at withdrawal is probably due to narrowness of the head, the descent being also assisted by the weight of the instrument. Independently of these mechanical features, however, the accident principally depends upon the selection of an instrument too small for the cavity that it is to occupy.

Recapitulating, we have then: Obstruction of the tube by detached membrane, due to the limited diameter of its interior.

Crowding down of loose membrane during the introduction of the tube, due to its inordinate length.

Passage of food through the tube into the trachea, due principally to its weight.

Momentary arrest of respiration during the introduction of the tube, due to the presence of the obturator.

Liability of the tube to be coughed out, due principally to the limited diameter of the interior.

Slipping of the tube into the trachea, due to its weight and to the conformation of its head.

We have now considered the principal defects of intubation, and I have given you what to me seemed to be their origin. I may be right, I may be wrong in my conclusions. I give them to you for what they are worth—food for thought. Let me say, however, as an

encouragement, that by eliminating from the statistics in my possession the cases of death that I thought might have been avoided, had the instruments reached the degree of perfection that they will some day reach, the proportion of recoveries, instead of 25 per cent., became 43 per cent. This is, of course, a mere estimate, imbued with a certain amount of guessing, but I feel confident that the time is not far distant when this record, at least, will stand to the credit of intubation. Then, even more than now, will O'Dwyer's patience and perseverance be appreciated. How many thousands of lives will it have saved!

In conclusion, I will show you a set of instruments that I have had constructed in which I have tried to incorporate the qualities that an intubation set should possess in accordance with the ideas set forth above. Their value will depend, of course, upon the correctness of my views. In devising them I based myself upon the principle that the natural conformation of the larynx should as much as possible be followed, in order to preserve for the patient, to the greatest degree possible, the natural physiological functions of the surrounding parts. They are more calculated to supply the larynx with a metallic coating to preserve its perviousness than with a tube, properly speaking. To construct the throat-piece, I took a plaster cast of a larynx, and this, in turn, served to sink a die, which was used to transfer its shape to thin sheets of metal (due attention being paid to strength). Each side being taken separately, two plates were obtained which, united on the sides, formed an accurate mold of the internal aspect of the laryngeal cavity from the ary-epiglottic folds down to below the vocal bands. You will notice, however, that the lower portion of the instrument extends on an average one inch below the bands. The two side-pieces are united immediately above the middle, and in doing so the edges are bent so as to prevent close apposition of the joints to the parts adjoining them. In this manner neither the anterior commissure nor the inter-arytenoid space is touched by the instrument. The two pieces work freely around the pins holding them together, the upper portions becoming approximated when the lower separate, and *vice versa*. When the latter is the case, the instrument assumes the shape of a sharp V. When it is introduced into the larynx it assumes the shape of a capital A, with a funnel at the top. In this position the separated lower branches are in the trachea, the narrow portion of the funnel is at the vocal cords, and the edge of the broad portion of the funnel is just below the ary-epiglottic folds, its shape being such as to avoid any inter-

ference with the epiglottis. The mold presented on each side, near the top, two rounded protuberances corresponding with the ventricles of the larynx. Reproduced in the instrument, these protuberances form a convenient supporting point, resting as they do on the vocal bands below and within the ventricles above, the edge of the ventricular band resting in turn in the recess formed by the protuberance and the lower portion of the funnel on each side. It is thus held securely, the vocal band preventing its descent and the ventricular band its ascent. The internal portions of the protuberances serve for the hooks of the forceps. The general appearance of the instrument is that of a bivalve speculum. Dr. O'Dwyer's first idea was to use such an instrument. After experimenting a few times with one, he abandoned it to resort to tubes. The defect was that the mucous membrane of the inter-arytenoid space and adjoining parts "pressed forward between the edges of the separated valves and the dyspnœa returned."* The mechanical error in this case was that the valves were united near the top, so that, when they were separated by the action of the spring, a gap occurred opposite the inter-arytenoid space and adjoining parts below, and also opposite the anterior commissure, thus enabling the swollen membrane to invaginate itself into the interior of the instrument. In the instrument now shown the point of union is nearly half an inch *below* the level of the vocal band, so that when the instrument is in position a complete tube is formed extending from the top of the inter-arytenoid space to almost half an inch below the vocal bands. Although not fitting tightly within the larynx, the adjustment is such that, like a well-fitting shoe, it can not produce irritation in any particular spot. Its movements are automatic, the vocal bands opening and closing the valves, according to the relative position they occupy with them. When they are introduced, closed below, and pushed downward, the moment the point of junction is reached, the valves open below and close above, forming the tube. When the instrument is withdrawn it remains closed above until the joint is reached, when it suddenly opens, the lower portions closing. This arrangement renders introduction and withdrawal exceedingly easy. This mechanical arrangement should obtain the following advantages:

1st. We have almost the same breathing space as in the normal larynx, thus preventing as much as possible obstruction by detached membrane.

2d. The comparative shortness of the instrument and the early

* Northrup, New York "Medical Record," Dec. 11, 1886.

separation of the lower portions of the valves reduce greatly the danger of crowding down loose pseudo-membrane.

3d. The light weight of the instrument and the shape of the head avoid interference with the act of deglutition.

4th. Separation of the valves a short distance above their tips, when closed, enables the patient to breathe freely while the instrument is being introduced.

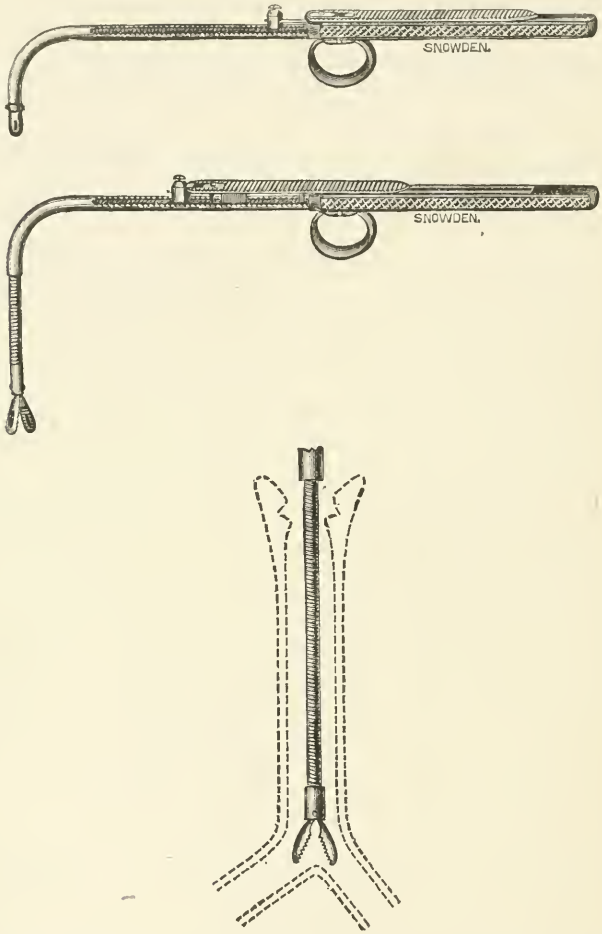
5th. The fact that the force of the air-current is exerted in the center of the instrument and has sufficient space to pass freely, renders ejection during cough almost impossible.

6th. The breadth of the head, the facility with which it can be grasped by the forceps, combined with the lightness of the instrument, make it impossible to force it into the trachea without fracturing the thyreoid cartilage.

As to the forceps, it only differs from ordinary instruments of that class in having a side-hook at each tip to penetrate the ventricular cavities of the speculum and hold the instrument fast. The tips can be extended so as to render the instrument applicable to all ages and depths of larynges. To engage the speculum in the grasp of the forceps, the tips of the latter are passed into the funnel-shaped cavity and then allowed to open. When the speculum is in the larynx this procedure, prior to extraction, is extremely simple. The forceps acting automatically, their tips have merely to be passed behind the epiglottis and depressed until an obstruction (the bottom of the funnel) prevents further progress. Allowing the forceps to open, they grasp the speculum firmly, when slight traction will suffice to withdraw it. This has been tried repeatedly upon the cadaver. The manipulation of introduction is that recommended by Dr. O'Dwyer for his instrument.

I wish also to show you an instrument devised for the purpose of withdrawing detached membrane from any part of the trachea, from the bifurcation up. It consists, as you can see, of a spiral tube, which, pushed out through the shaft of the body of the instrument, can be lengthened at will from the handle. A small blunt forceps is mounted on the end of the spiral tube, which forceps opens while on the descent and closes as soon as the spiral tube is drawn home. This instrument can be used with the speculum *in situ*, and is so constructed as to not interfere with respiration. For the extraction of foreign bodies from the trachea it will also, I think, render valuable services. I have already had occasion to use it, with gratifying results.

You will pardon me for introducing the laryngeal specula to you before having tried them upon the living subject, the crucial test—



the only one, in fact, that can render them worthy of your attention. You will kindly remember that they are merely brought before you to illustrate the ideas set forth in my paper, and that eighteen months will probably elapse before we meet again, and therefore eighteen months before I have an opportunity of showing them to you. My future plan of procedure with them will be to try them in a number of cases, and when found satisfactory in my hands, I will place a number of sets at the disposal of several general practitioners and

request them to study the defects that they may present in *their* hands (naturally not so accustomed to the manipulation of laryngeal instruments as mine), and, these defects once corrected to their and my satisfaction, I shall again have the pleasure of bringing them before you, but in a more mature form.

Discussion.

Dr. F. H. Hooper, of Boston, said that he had had no experience with the operation, but had watched some of the cases at the Boston City Hospital, notes of which, furnished him by the house-officer, Mr. W. H. Prescott, showed that there had been ten intubations performed in the institution, with two recoveries. One attempt to introduce the tube caused spasm of the glottis, and tracheotomy was performed. In another case the tube could not be introduced, and tracheotomy was performed. In every case in which intubation was performed, the relief from dyspnœa was immediate and as complete as after tracheotomy. Three tubes had been coughed up and swallowed—two with the silk still attached, and one after it had been removed. Very little discharge had been set up by the tube, and there had been no trouble with regard to feeding. One patient nursed without difficulty with the tube in the larynx. There had been no trouble in extracting the tube. In one case the tube, after remaining in the larynx sixty hours, became plugged with membrane, and had to be removed, but was inserted again. In another case the tube became filled with membrane at its first insertion, and was coughed up; that, too, was inserted again. Another was stopped up with thick mucus, and had to be removed, to be inserted again. Two of the cases had seemed hopeless at the time of the operation, which was done simply to prevent strangulation. One patient, weakened by previous disease, died of exhaustion; one died of measles and pneumonia, three of septicæmia, two of septicæmia and complications, and one of heart failure. The diet employed was of milk, beef-tea, chicken-broth, and custard. A light steam was used in the treatment; poultices were applied to the chest and neck; a dropperful of a 1-to-15,000 solution of corrosive sublimate was instilled into the nose three times a day when there was any nasal discharge; the throat was sprayed with Dobell's solution; small doses of corrosive sublimate were given, with pepsin in one case; two drops of tincture of digitalis were given morning and evening when the urine was scanty; pepsin was used when the stomach was out of order; and a teaspoonful of brandy was given every three hours.

Dr. D. B. Delavan, of New York, said that that part of Dr. Ingals's paper which related to feeding the patient while the tube was in the larynx he regarded as very important. He had before proposed, and the point was worthy of consideration, that, when necessary, the patient might be fed through a small tube introduced into the œsophagus. More than a year ago Mr. Henry Butlin, of London, had written him stating that for

some time he had practiced in his wards in St. Bartholomew's Hospital the method of feeding tracheotomized patients by means of a small œsophageal tube, and said that since he and his assistants had carried out this plan the percentage of recoveries had been materially increased. The speaker thought the method was a good one, and worthy of a trial in some of these cases of intubation. He regarded the constant presence of a thoroughly competent attendant as of great importance.

Dr. Morris J. Asch, of New York, thought intubation of the larynx not only extremely interesting, but also extremely valuable; it had done a great deal of service in relieving patients of dyspnœa, even if it had not cured disease. Still, there were a few objections to it which he thought ought to be noticed. One was a very serious one, namely, that false membrane might be crowded down before the tube and create a dyspnœa which it was very difficult, if not impossible, to relieve, although tracheotomy was resorted to. Such a case had occurred very recently in New York. Intubation of the larynx was done in a grown person, false membrane was forced down before the tube, and tracheotomy had to be performed to save the patient's life. The other objection which general practitioners made to the tube was the extreme difficulty of removing it, one or two patients having died during attempts at its extraction.

Dr. B. F. Westbrook, of Brooklyn, thought that, if there were some means of attaching a thread or fine wire to the tube by which it could be removed with ease by those not accustomed to laryngeal manipulation, it would be a great advantage. The general practitioner was more likely to be called upon to do intubation than the laryngologist or the surgeon; hence the importance of an easy method of removing the tube. With regard to the interference with deglutition, he did not think the tube was heavy enough to interfere with the movements of the larynx. The muscles which caused the movements of the larynx and trachea in the act of swallowing were very powerful, and a slight weight would not be any restraint upon them. It seemed to him that the difficulty with deglutition consisted in the presence of a rigid tube which left the entrance to the larynx open. Still, this seemed to be a necessary evil. No elastic instrument, he thought, would accomplish what the rigid tube had done.

Dr. J. Solis Cohen, of Philadelphia, said it might seem strange for a man who had had no experience with intubation to have anything to say about it. Still, he had given the subject a good deal of thought; he had seen one or two cases of intubation; and on one or two occasions, when called upon to perform tracheotomy, he had been able to introduce the laryngeal tube when the gentleman in charge had failed to do it. He had been very much struck with Dr. Ingals's statement, that after intubation the patient required no more attention than if the operation had not been performed. That was undoubtedly not in accord with the views entertained by some writers, and also with some statistics which Dr. Ingals himself had given in his paper. He had mentioned one or two instances in which the patient died shortly after the tube had been coughed out,

and in others we knew the patient had died because there was no one to remove the tube and it could not be coughed out. As the removal of the tube required much more skill than its introduction, the speaker would think it more important to have a skilled attendant at the bedside of the patient the next day or two after its introduction, ready to remove the tube in case of accident, than if tracheotomy had been performed. If a tracheotomy-tube became occluded, it was very easy for the nurse to remove it, and there would be the ordinary wound, through which the patient could breathe until the physician was called, or the sides of the wound could be held open.

With regard to the difficulty of taking food after intubation, if it were necessary, fluids and fluid nourishment could be given, as they were sometimes given to the insane, through a soft catheter passed through the nose into the œsophagus. The speaker had had no experience with this method; it might be impossible in children. Much had been said about the difficulty of withdrawing the tube by the forceps devised by Dr. O'Dwyer, and it would seem that this difficulty could be overcome by making a recess in the tube into which a corresponding projection on the forceps would fit.

With regard to Dr. Sajous's instrument, he had nothing to say further than that he would prefer to suspend judgment regarding his method until it had been used with success on the living subject.

Dr. S. H. Chapman, of New Haven, said that, although the entrance of fluids into the trachèa was dangerous, yet one of the most distressing symptoms after intubation was thirst. Could we not in these cases give sufficient fluids by the rectum for the few days during which the laryngeal tube was in place? Again, was it not possible to introduce mercury into the system by some other means, as by inunction, so that the distressing symptom of dryness of the mouth caused by giving it in that way might be avoided? Was it not also possible, by means of washing and bathing the mouth with some fluid, to relieve the thirst?

Dr. Ingals would say, with regard to the withdrawal of the tube, and the necessity for having a trained attendant present ready to withdraw it should it become necessary, that at first he had held the same views presented by Dr. Cohen, but now he had no fear whatever of the tube becoming clogged and choking the child. The accident was so rare, and the child was so much more likely to die in some other way, that the possibility of the accident did not trouble him. The withdrawal of the tube was much more difficult than its introduction—so difficult that anæsthetics had been recommended. However, he did not know that much trouble had arisen in this respect. There had been two or three children killed in attempts to withdraw the tube by physicians who had too great faith in their skill and failed to send for a laryngologist when they recognized the difficulty. The laryngeal mirror, however, was not commonly used in accomplishing this.

The tube, if it became clogged, was almost sure to be coughed up if

of proper size. A wire or a thread left attached to the tube, to facilitate its extraction, had been found to produce too much irritation.

Feeding through a tube introduced into the œsophagus had been practiced in a few instances in Chicago—he did not know with what success. The gentlemen who had practiced it seemed to have little to say about it.

Dr. Sajous wished to say that he had presented his instruments merely in illustration of the principal objections to Dr. O'Dwyer's tubes, not because of their demonstrated superiority, for he had in the short time since they had been made had opportunity to use them only in experiments upon the dead body. They had been presented principally for the purpose of raising a discussion and of thus overcoming difficulties connected with intubation. He might say, with regard to his tube, that it could be extracted with the greatest ease. The upper end of the instrument formed a kind of funnel, and in extracting it the operator had simply to let the forceps drop into this funnel; then it would become firmly fixed in the tube, enabling the operator, if necessary, to use great extractive force.

Paper.

DESCRIPTION OF A MODIFIED LARYNGECTOMY.

By J. SOLIS-COHEN, M. D.

IN many larynges removed entire or practically entire for carcinoma or for other disease rendering their retention perilous to the life of the individual, there has not been the slightest evidence of disease found in the thyroid cartilages. It seems barbarous to me, therefore, other things being equal, to remove these structures unnecessarily; the more that dangers from the operation, immediate and remote, are infinitely greater than when the cartilages can be left in their normal situation with the inferior constrictor muscles of the pharynx in position, and many other structures left undisturbed which, in complete laryngectomy, are necessarily injured, disturbed, and left exposed. The operation about to be described removes the entire respiratory portion of the larynx, leaving the greater portion of the protecting thyroid cartilages undisturbed to perform their function as shields. As performed on the dead subject by myself and by Dr. Edward Martin, my chief of clinic in the laryngological department of the Philadelphia Polyclinic, an exsection of the larynx, such as is shown in the specimen herewith exhibited, can be done within two minutes. The gap left in the body is insignificant in comparison to that following complete laryngectomy, and a firm

support is retained for the accommodation of an artificial substitute for the parts removed. The operation will give sufficient access in many cases for removal of implicated portions of œsophagus and pharynx; and in cases of disease limited to the interior of the respiratory tube, or to the soft portions of the larynx, especially in cases not carcinomatous, it should fulfill every indication which has prompted entire laryngectomy, and without exposure to risks as great. It is applicable to the unilateral procedure as well as to the bilateral one.

After I had performed this operation on the cadaver by several methods from above and below, and was desirous of determining which was the most expeditious and the readiest, Dr. Martin kindly performed some twenty or more additional operations.

Instruments required: a cartilage knife; a scalpel, medium size; a pair of strong cutting forceps, with narrow blades; blunt and sharp-pointed scissors; two strong blunt hooks, or retractors; volsellum forceps, artery forceps, bull-dogs, dissecting and dressing forceps; tenacula; director, ligatures, sutures, needles.

The following detailed steps in the operation are presented by Dr. Martin and myself as the result of these investigations:

1. Make an incision from the hyoid bone to the lower border of the cricoid cartilage, and exactly in the middle line.

2. Carefully separate the sterno-hyoid muscles.

3. Hold the soft parts aside and insert, from above, one blade of a strong cutting forceps with narrow blades beneath one wing of the thyroid cartilage, one fourth of an inch from the angle of junction with its fellow, and sever the cartilage vertically its entire length through to the crico-thyroid membrane.

4. Make a similar cut on the opposite side.

5. Seize the freed angular portion of the thyroid cartilage, comprising its entire respiratory contingent, with a volsellum forceps and draw it to either side, the soft parts being separated meanwhile from the inner surfaces of the detached wings of the thyroid cartilages with the handle of the scalpel.

6. Make a transverse cut to sever the cricoid cartilage from the trachea. (At this step, in the living subject a sterilized cotton plug should be inserted into the upper end of the trachea, preliminary tracheotomy having been performed previously.)

Note.—If the cricoid cartilage is to be retained, disarticulate the arytenoids, and then sever the soft parts above the cricoid instead of below. This modifies the next step in the procedure accordingly.

7. Lift the cricoid cartilage forward and carefully separate it with the edge of the knife from the inferior cornua of the thyroid, laterally and superiorly, and then from the œsophagus posteriorly.

8. Insert a finger into the pharynx from below and carry its tip over the epiglottis to draw that structure down.

9. Divide the thyro-hyoid membrane and the fibrous tissues still holding.

10. Lift out the exsected respiratory portion of the larynx.

The arteries likely to require ligation will comprise small branches of the superior, middle, and inferior laryngeals.

Upon the living subject the operation should be strictly aseptic, and where practicable should have been preceded by several days by a preliminary tracheotomy. The trachea may be occluded superiorly by a small rubber bag attached to the smallest-sized soft catheter, introduced through the tracheal wound, above the cannula, and then inflated. The cannula may be temporarily removed during the introduction of the bag and its inflation.

Advantages alleged for this procedure:

1. Its rapidity, ease, and comparative safety to the patient.

2. The small size of the wound.

3. The preservation of the attachments of the thyro-hyoid ligament and the greater part of the membrane, and of the thyro-hyoid, sterno-thyroid, stylo-pharyngeus, and inferior constrictor muscles; leaving—

4. Important functional structures retained in their normal relations for deglutition; and leaving—

5. A firm, natural support for the adjustment of artificial substitutes for the larynx.

For these reasons it is submitted that this procedure should be preferred to complete laryngectomy whenever not precluded by extent of disease.

Business Meeting.

At the close of the scientific proceedings, the association went into executive session.

The following committees were appointed by the President:

Auditing Committee.—Dr. Morris J. Asch, New York; Dr. John O. Roe, Rochester; Dr. B. F. Westbrook, Brooklyn.

Nominating Committee.—Dr. William C. Glasgow, St. Louis; Dr. S. H. Chapman, New Haven; Dr. Beverley Robinson, New York.

First Day—Afternoon Session.

Paper.

THE ANATOMY AND PHYSIOLOGY OF THE RECURRENT LARYNGEAL NERVES.

By FRANKLIN H. HOOPER, M. D.

I. Anatomy.

NOTWITHSTANDING the centuries that have elapsed since the reputed discovery of the recurrent laryngeal nerves by Galen, it is doubtful if there be another pair of nerves in the body which have given rise to so many diverse and fanciful theories to account for the anatomical peculiarity of their course or to elucidate their physiological functions. At the present day our knowledge of the anatomy of these nerves is, for the most part, complete and exact. The reason why they are not given off by the pneumogastrics at a point opposite the larynx so as to reach that organ by the shortest route, instead of branching from the pneumogastrics low down in the neck and running a complicated and recurrent course to the larynx, is now clearly understood. Yet Magendie,* in his lectures on the nervous system, delivered at the Collège de France at so recent a date as 1836, asserted that this was a problem which anatomists were unable to solve. But several years prior to the date of Magendie's lectures two articles had appeared in a Scotch journal which, had they come under his notice, would have given him a clew to the explanation of the matter.

Stedman, in 1823, in a paper entitled "A Singular Distribution of some of the Nerves and Arteries in the Neck and the Top of the Thorax,"† gives a description and a drawing of his dissection of an aged female in whom he found that the right recurrent laryngeal nerve was absent. There were, however, nerves given off from the trunk of the pneumogastric, about the middle of the neck, which went direct to the larynx. He also found, in the same subject, an irregularity in the origin and course of the right subclavian artery. It arose from the arch of the aorta behind and a little to the left side of the left subclavian artery, and, forming an arch, pierced between the œsophagus and vertebral column in the region of the first verte-

* "Lancet," July 1, 1837, p. 503.

† "Edin. Med. and Surg. Jour.," xix, 1823, p. 564.

bra of the back, and then passed over the first rib on the right side. Stedman was the first to cite an example of the connection between an irregular origin of the right subclavian artery and right recurrent laryngeal nerve—a connection which we now know is constant; but he dismissed the subject with the comment that the nerve, in his case, which went direct to the larynx from the pneumogastric probably performed the same functions as the recurrent, and that nature seemed to have been forced to have recourse to this arrangement from the singular situation of the subclavian. Three years after the appearance of Stedman's paper, Hart (1826) reported in the same journal* "A Case of Irregular Origin and Course of the Right Subclavian Artery and Right Inferior Laryngeal Nerve." The artery arose from the aorta direct, and the nerve, instead of being recurrent, went straight from the pneumogastric to the larynx. Hart speculates upon the reason why the nerve in this instance should have been straight and short, and, although his views are not strictly in accord with the teaching of modern embryologists, they show that he was aware that the secret of the circuitous course of the inferior laryngeal nerves was to be sought in the natural law of embryonic development. He says: "In the earlier periods of the existence of the fœtus the rudiment of the head appears as a small projection from the upper and anterior part of the trunk, the neck not being yet developed. The larynx at this time is placed behind the ascending portion of the arch of the aorta, while the brain, as it then exists, is situated so low as to rest on the thymus gland and front of that vessel. Hence it is that the inferior laryngeal nerves pass back to the larynx, separated by the ascending aorta, the left going round its arch, while the right goes below the *arteria innominata*. As gestation advances, the head becomes more distinct, and the neck begins to be formed after the second month, which, as it lengthens, has the effect of moving the brain upward to a greater distance, and of drawing out the larynx from the chest, in accommodation to which the nerves of the par vagum and their recurrents become elongated, and hence the circuitous route the latter are found to take afterward, forming loops in which the aorta and right subclavian artery are, as it were, suspended. . . . Had not the great blood-vessels been originally thus interposed between the brain and larynx, the inferior laryngeal nerves would not have been entangled by them, and we should find them in the adult taking the nearest route to their destination."

* "Edin. Med. and Surg. Jour.," April, 1826, p. 286.

These early papers upon this subject are most interesting, and show that their authors were careful observers. They pointed out the right path, which, however, was not followed by all subsequent writers who expressed themselves on the question.

Swan, for instance, entertained certain theories in regard to the influence which the blood-vessels had upon the nervous system, and in "An Essay on the Connection between the Action of the Heart and Arteries and the Functions of the Nervous System," London, 1829, p. 50, he applied his views in a very curious way to explain the recurrent course of the inferior laryngeal nerves. After speaking of their encompassing the subclavian artery on the right side and the arch of the aorta on the left, and remarking that it was very singular that neither of the carotids was included, he says: "I conceive this disposition was intended for producing a more extensive sympathy between the arteries of those parts of the body which are subjected to be excited by exercise, and the glottis; for when the action and distension of the arteries are increased by exercise, the recurrent nerves become stimulated, and consequently the muscles of the glottis, the opening of which thus becomes widened, so as to admit a greater and more free supply of air into the lungs. It may be supposed that any other disposition would have sufficed, so long as the parts were properly supplied with nerves, and a case is related by Dr. Stedman where the recurrent was wanting on the right side, and its place was supplied by numerous branches of the par vagum; but in this instance 'the right subclavian artery rose from the arch of the aorta behind and a little to the left side of the left subclavian, and, forming an arch, pierced between the œsophagus and vertebral column in the region of the first vertebra of the back, and then passed over the first rib on the right side.' It must be remarked that the right subclavian was already under the influence of the left recurrent, and therefore the usual distribution was not necessary on the right side. The same unusual distribution I have also observed in a rabbit, which was very healthy, but I never saw it in exercise, and therefore can not determine whether its respiration was affected during that state. It is a curious circumstance that the recurrents do not always include the carotids; but it seldom happens that the action of these arteries is much increased, except by the exertions of the voice, as in singing, etc., and therefore, if they had been included, the delicate and complicated actions of the glottis, which are produced during these processes, might have been too much interfered with, and I believe a compensation is made for this omission

by the connection of the pharyngeal plexus with the superficial cardiac nerve. . . . The subclavian artery on the right side and the aorta on the left are almost encircled by the par vagum and its recurrent branches. This distribution, no doubt, connects the actions of these arteries with those of the glottis."

Hilton (1837), to whom we are indebted for an admirable paper * describing the distribution of the recurrent nerves, states in a foot-note that he had seen a subject in his dissecting-room in which the right subclavian artery came off from the posterior part and left side of the transverse portion of the aorta. In this case, he continues, "the right recurrent nerve did not curve round the artery, but was detached from the pneumogastric at an acute angle with the descending part of the nerve, about opposite the fifth cervical vertebra." We find, moreover, in the same writer's well-known "Lectures on Rest and Pain," † the statement that he had seen examples in which the recurrent did not wind around the arch of the aorta or the subclavian artery, yet the course of the nerve was, notwithstanding, equally recurrent, thus clearly indicating that it had no necessary relation with the subclavian artery or the aorta. He then sets forth the following singular theory to explain the course of these nerves: "The nervous influence, whatever it may be, which travels by these recurrent nerves, goes from below upward. And I think it will be apparent why this nerve takes its course from below upward. It is an essential thing, to my mind, that the muscles which are acting upon the air as it escapes outward from the lungs so as to make the voice, should be acting from within outward—that is, from the lower part of the larynx to the upper. It is quite obvious that if they acted in the other way we should all be ventriloquists, talking inwardly to ourselves, as it were, and having no external voice; and it is for the purpose of determining the direction of influence from within outward that we find this nerve pursuing this singularly recurrent course."

Meckel ‡ says the recurrent nerve is sometimes double, and, though rare, when this occurs it is always on the right side. He considers it probable "that the recurrent nerve results from the plexiform division of the trunk of the pneumogastric, and that its existence is connected with the primitive shortness of the neck, since the larynx is much nearer its origin in the early periods of

* "Guy's Hosp. Reports," vol. ii, 1837, p. 514.

† Second edition, London, 1877, p. 217.

‡ "Manual of Anatomy." Translated by Doane, 1832.

life than subsequently. This hypothesis would explain its arrangement in the same manner as the high origin and long course of the spermatic vessels."

Daremberg,* in speaking of the recurrent nerve twisting round the subclavian artery on the right side and the arch of the aorta on the left, says: "Que la nature a disposeés comme deux bornes qui les fixent dans la carrière qu'ils ont à fournir avant de se répandre dans les muscles abaisseurs du larynx, qu'ils font mouvoir comme avec une main."

If we wish to obtain a clear idea of the reason why the recurrent nerves recur, we must leave this speculative ground and begin at the beginning of the development of the embryo. These remarkable nerves exist at a very early period of fœtal life. At a certain stage of embryonic development they have, indeed, a transverse direction, and proceed direct from the pneumogastrics to their destination, and their recurrent course is determined later solely through developmental changes in the branchial apparatus of the embryo, and to the descent of the heart into the thorax. We will briefly review these changes: In the cervical region are developed the five pairs of aortic arches—a transitory fœtal apparatus in the higher vertebrates. Of the five pairs of arches, but two are permanent at birth, namely, the fourth arch on the left side, which is represented by the arch of the aorta, and the corresponding arch on the right side, which has become the right subclavian artery. The recurrent nerves originally passed under the fifth pair of aortic arches; but as the *ductus arteriosus*—the fifth arch on the left side—is obliterated after birth, it follows that the left recurrent nerve is hooked under the first permanent arch above it, namely, the fourth, which has become the arch of the aorta; while on the right side the fifth aortic arch disappears entirely, and the right recurrent consequently passes under the fourth aortic arch, which persists as the right subclavian artery.

The long course of the recurrents, like the elongation of the carotids and other anatomical features of the cervical region, is brought about by the change of position which the heart and great vessels undergo during embryonic life, and which we may best describe by borrowing Huxley's words:† "At first the heart of a mammal lies under the middle of the head, immediately behind the first branchial arches, in which the first pair of aortic arches ascend. As the other

* "Exposition des connaissances de Galien," etc., Thèse, Paris, 1841, p. 57.

† "A Manual of the Anatomy of Vertebrated Animals," London, 1871. We take the liberty of substituting the word "branchial" for "visceral."

pairs of aortic arches are developed the heart moves backward, but the fourth pair of branchial arches, by the modification of one of which the persistent aorta is formed, lies, at first, no farther back than the occipital region of the skull, to which the fourth pair of branchial arches belongs. As the two pairs of cornua of the hyoid belong to the second and the third branchial arches, the larynx is probably developed within the region of the fourth and fifth branchial arches; hence the branches of the pneumogastric, with which it is supplied, must, originally, pass directly to their destination. But, as development proceeds, the aortic arches and the heart become altogether detached from the branchial arches and move back, until at length they are lodged deep in the thorax. Hence the elongation of the carotid arteries; hence also, as the larynx remains relatively stationary, the singular course in the adult of that branch of the pneumogastric, the recurrent laryngeal, which primitively passed to the laryngeal region behind the fourth branchial arch, and consequently becomes drawn out into a long loop, the middle of it being, as it were, pulled back by the retrogression of the aortic arch into the thorax."

The proof that the course of the recurrent nerves is a question of development is found in the fact that when, from any cause operating in early fœtal life, irregularities of the arch of the aorta or in the origin of its primary branches exist, the recurrent nerves have always in such instances an anomalous origin and course. There are several recorded cases of this inter-relation of these anomalies. We have already mentioned Stedman's paper, in which he described, for the first time, a case of irregular origin of the right subclavian artery associated with absence of the right recurrent nerve. In this case, undoubtedly, the fourth right aortic arch disappeared very early, and, the right subclavian arising from the descending portion of the aorta, there was nothing to carry the right recurrent down, and it consequently ran directly to the larynx. Through the kindness of Professor Dwight we have had an opportunity of observing a similar case in the dissecting-room of the Harvard Medical School. Hérard* in 1846 showed a specimen at the Anatomical Society of Paris, in which the right recurrent was given off from the pneumogastric opposite the cricoid cartilage, and he suggested that we ought to be prudent in denying the existence of the recurrent if we did not find it in its proper place. The left recurrent was normal. He makes no

* "Bull. de la Soc. anat. de Paris," 1846, p. 111.

mention of any anomaly of the blood-vessels. Reid,* in 1847, gives the correct explanation of the origin of these anomalies, and says that in those cases of monstrosity where the head and larynx are double, and the two bodies are fused together immediately below this, so that the lower part of the neck, the thorax, and thoracic extremities are single, and where consequently we have four vagi nerves in the upper part of the neck and only two at the lower part, the right recurrent of the right larynx hooks round the subclavian artery, and the left recurrent of the left larynx hooks round the arch of the aorta, while the left recurrent of the right larynx and the right recurrent of the left proceed to their destination from the pneumogastrics as they pass the larynges. Demarquay† (1848) was, we believe, the first one in France to record a case of irregular origin of the right subclavian artery with absence of the recurrent nerve on the same side.

Professor Turner, in his admirable paper,‡ cites cases where there was no innominate artery and an unusual origin of the right subclavian. In one instance the recurrent turned round the inferior thyreoid artery, and in others it passed directly inward to the larynx. He also describes cases where the aorta arched to the right side, in which the left recurrents wound round the obliterated ducti arteriosi while the right recurrents passed behind the arches of the aorta. Krause and Telgmann# add to the number of irregular origins of the subclavian artery and recurrent nerves, which, according to Turner, occur once in two hundred and fifty cases.

More recently, Brenner,‖ in an interesting paper, describes two instances of this anomaly, and a third where the right recurrent branched from the pneumogastric opposite the sixth cervical vertebra, and turned round the vertebral artery to reascend to the larynx. Here the right vertebral artery represented the fourth right aortic arch. The branches from the aorta in this case were in this order: First, a vessel that divided some two inches from its origin into the right vertebral and the right carotid; then came the left carotid, the left vertebral, the left subclavian, and finally the right subclavian from the descending aorta. He further reports two cases where the aorta

* Todd's "Cyclopædia," article "Par Vagum," 1847.

† "Gaz. méd. de Paris," 1848, p. 714.

‡ "On Irregularities of the Pulmonary Artery, Arch of the Aorta, etc.," "Brit. and Foreign Med.-chirurg. Review," vol. xxx, 1862, p. 173.

"Die Nervenvarietäten des Menschen," Leipsic, 1868.

‖ "Ueber das Verhältniss des Nervus laryngeus inferior vagi u. s. w." "Arch. für Anat. und Entwickelungsgesch.," 1883, p. 373.

passed over the right bronchus, in which the left recurrents passed under the fifth left branchial arches represented by the obliterated ducti arteriosi. The last writer who has called our attention to this subject is Chaput, whose "Note sur un rapport peu connu du recurrent gauche" may be found in the records of the "Soc. anatom. de Paris," July, 1884.

To return now to the normal relation of the recurrent nerves to the large blood-vessels, we find (Luschka) that the left recurrent leaves the pneumogastric at an acute angle in front of the arch of the aorta; it then turns round the vessel from before backward, runs up between it and the left bronchus, following the posterior surface of the aorta, which it leaves between the origin of the left common carotid artery and the subclavian to ascend to the larynx in the sulcus between the œsophagus and trachea. The right recurrent, which is shorter than the left, branches from the pneumogastric in front of the right subclavian artery. Turning under that vessel and running up behind the right common carotid, which it crosses to reach the fissure between the œsophagus and the trachea, it then proceeds to the larynx. In their course the recurrents send communicating branches to the cardiac and pulmonary nerves, and supply the œsophagus, trachea, and inferior portion of the pharynx with numerous filaments.

Rainey,* Hilton,† and Habershon,‡ from their own dissections, have described communicating filaments, running from the recurrents to the superior laryngeal nerves, while Philipeaux and Vulpian# maintain that the anastomosing fibers which are found come exclusively from the superior laryngeal nerves. Luschka‖ believed that in reality there was no communication between the superior and inferior laryngeal nerves, and that those filaments coming from the superior laryngeal which had this appearance were sometimes merely enveloped for a short distance in the same sheath with the inferior laryngeal, and at other times crossed it superficially at an acute angle to be distributed in the mucous membrane of the pharynx. Exner,△

* "The Recurrent Laryngeal Nerves," London "Med. Gazette," December 6, 1828.

† "Guy's Hosp. Reports," vol. ii, 1837, p. 514.

‡ "The Pathology of the Pneumogastric Nerve," "Med. Times and Gazette," vol. i, 1876.

"Sur l'anastomose qui existe entre le nerf laryngé supérieur et le nerf recurrent," "Arch. de physiol. norm. et path.," tome ii, 1869.

‖ "Der Kehlkopf des Menschen," Tübingen, 1871.

△ "Sitzungsber. d. Wiener Akademie d. W.," Bd. lxxxv, 1884.

on the other hand, in one of the latest and most elaborate monographs on the innervation of the larynx, describes and pictures the ramus communicans, or "Galen's anastomosis." The relations of the inferior thyreoid artery and the recurrent laryngeal nerve are of practical importance in operations upon the œsophagus, and for the removal of the whole or a part of the thyreoid gland. Referring to Professor Dwight's * paper on this subject, we find that Woelfler † stated that the nerve always passed before a branch of the artery. Kocher, ‡ on the other hand, describes the artery as passing behind the nerve, coming forward on its inner side and bending over it. Rotter # made some fifteen examinations, and found the artery in one third as described by Kocher. Dr. Streckeisen ‖ reports the results of the examination of both sides of fifty-six bodies. He appears, however, to have had chiefly in mind the question whether or not the artery formed a loop around the nerve, and, if so, to what degree it surrounded it. It is not quite clear, therefore, in how many of his cases the artery passed before or behind the nerve. Dwight examined fifty-two bodies on both sides, and twenty-seven on one side. He found that on the right the artery was before the nerve thirty-three times, and behind it thirty-one. On the left the artery was before the nerve forty-nine times, and behind it fifteen. It appears, therefore, that the probabilities are equal that the right nerve or artery will be in front, and that on the left the chances are three to one that the nerve will be behind. Professor Dwight concludes that his series tend to support the practical deduction that, when it is necessary to tie the artery near the gland, the vessel should be carefully isolated.

It has been stated that the recurrent nerves contain sensory fibers, but we are not aware of any experimental proof to support this opinion. In our judgment, this point may be determined by the following methods:

Experiment.—Anæsthetize a dog or a cat, and fix it on its back, with its lower jaw held open, so that a perfect view of its glottis can be obtained through the mouth by throwing in light by means of an ordinary head-reflector. The animal's tongue may be held out by the fingers of the left hand, and the epiglottis raised with a long

* "Boston Med. and Surg. Journal."
† "Wiener med. Wochenschr.," 1879.
‡ "Arch. für klin. Chirurgie," Bd. xxix, 1883.
# "Archiv für klin. Chirurg.," Bd. xxxi, 1885.
‖ Virchow's "Archiv," Bd. ciii, 1886.

forceps by the right hand. The recurrent nerve having been exposed and *cut*, the corresponding vocal band will be seen to be completely immovable, while its fellow moves rhythmically with respiration. Place an electrode on the central cut end of the recurrent, and stimulate with currents from the feeblest to the strongest intensity; no effect whatever will be produced on the glottis. But, if we now change the electrode from the cut end of the recurrent to the trunk of the pneumogastric of the same side, and stimulate it, we do obtain a decided reflex effect upon the glottis, which was impossible when its recurrent branch was irritated. But perhaps a still more delicate proof that there are no sensitive fibers in this nerve is furnished us by the absence of a rise of blood-pressure in curarized animals on stimulation of its central end after section. The observation of Ludwig and Thiry that irritation of sensitive nerves was followed by a rise of the blood-pressure occasioned by reflex contraction of the muscular coats of the arteries led us to apply this test to the recurrent, the method employed being that described by Dittmar and Miescher in their researches* on the sensitive fibers in the spinal cord.

We have used dogs and cats for this purpose without, in a single instance, being able to observe a rise of the blood-pressure when the recurrent was stimulated with weak or strong currents, which invariably followed when the internal popliteal nerve was irritated. We subjoin the details of one of the experiments, and the curves showing the difference between the action of these two nerves on the blood-pressure.

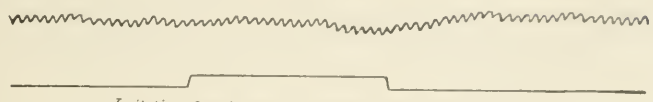
April 13, 1887.—Small black-and-tan dog. Curarized. Artificial respiration. Left recurrent and left internal popliteal nerves laid bare and cut previous to stimulation. The recording pen of a mercury manometer, which was connected with the right femoral artery, recorded the blood-pressure on a long roll of paper in the usual manner.

By reading these tracings from right to left, it will be seen that irritation of the recurrent nerve with a very powerful current was not followed by any change of pressure, while, when the internal popliteal was stimulated, a marked rise was observed. We consider, therefore, that, as far as dogs and cats are concerned, the recurrents are purely motor nerves.

The recurrent nerve does not become the inferior laryngeal proper

* "Arbeiten a. d. physiol. Anstalt," Leipsic, 1870.

until it has reached the lower border of the cricoid cartilage. It is here about one millimetre in diameter.



Irritation of central end of left recurrent nerve. I = 200.

Irritation of central end of left internal popliteal nerve. I = 200.

Passing under the lower border of the inferior constrictor muscle of the pharynx, it enters the larynx behind the articulation of the inferior cornu of the thyreoid cartilage. It then divides into several branches, which innervate all the muscles of the larynx except the thyreo-cricoids. It is an occasional, but not a constant, phenomenon, that excitation of one of the recurrent nerves will cause a contraction of the vocal band of the opposite side, which tends to confirm the statement that there are connections between the terminal filaments of the recurrents in the laryngeal muscles. Such, then, being the course and distribution of the recurrent nerves, it remains now to investigate their rôle in carrying on the different functions of the larynx.

II. Physiology.

In looking through the mass of writings and experiments, from remote times to the present day, upon the physiology of the recurrent laryngeal nerves and the parts which they supply, we are struck, first of all, by the many discordant opinions that have been, and still are being, recorded, and feel that the old aphorism, "experiment is fallacious and decision difficult," is as applicable to the nineteenth century as to the time when Hippocrates gave it utterance. Yet, when we consider the improvement in recent years in instruments of research, and reflect upon the advance and development of physical science, we may ask if it is not now, perhaps, the experimenter that is fallacious, and not the experiment.

It is, indeed, surprising that scarcely fifty years have passed since the first experimental study of questions pertaining to the larynx

which approached completeness and was of real scientific value. We refer to a paper by John Reid (1838), of Scotland, the title of which, however, would not lead one to look for as much valuable work upon the nerves of the larynx as it contains. This important paper, to which we shall again refer, was entitled "An Experimental Investigation into the Functions of the Eighth Pair of Nerves, or the Glosso-pharyngeal, Pneumogastric, and Spinal Accessory,"* and was founded upon experiments which, as Romberg† justly says, may serve as models of philosophical inquiries.

We know, however, that from the earliest times the voice has enlisted the attention and speculation of physiologists, but the experiments of all, from Rufus the Ephesian down to Reid (1838), except, perhaps, Magendie's, were directed chiefly to finding out what influence the pneumo-gastrics or the recurrents had upon the function of phonation; whether the voice was lost after section of these nerves; and whether it could be regained when once taken away in this manner.

Rufus of Ephesus, Galen, Vesalius, and others found that the voice was lost after the pneumogastrics or the recurrents had been cut or included in a ligature, although less careful observers came to different conclusions; but we need not at present review in detail the investigations of these early writers, inasmuch, as we have just mentioned, as their researches had reference solely to the relation of these nerves to the voice.

To come down to more recent periods (1734), one of the earliest papers is by Martin, entitled "The Experiment of cutting the Recurrent Nerves carried on farther than has hitherto been done."‡ We find in it, however, little to justify the title, as Martin confined himself to cutting the recurrents of a sucking pig in order to observe the effect on the voice, and recorded that, after the operation, "it could never give a squeak in the ordinary manner of these animals."

A more elaborate paper, by Haighton (1792), followed Martin's, on "Experiments made on the Laryngeal and Recurrent Branches of the Eighth Pair of Nerves, etc.,"# in which he calls attention to the "contrariety of opinions" that then prevailed, and adds, significantly: "This may possibly excite astonishment, when we consider that the subject is not of very difficult investigation, requiring for its

* "Edin. Med. and Surg. Journal," vol. xlix, 1838, p. 109.

† "The Sydenham Soc.," vol. ii, 1853, p. 313.

‡ "Medical Essays of Edinburgh," vol. ii, 1734, p. 114.

"Mem. of the Medical Soc. of London," vol. iii, 1792, p. 422.

accomplishment very little more than an unprejudiced mind and a hand accustomed to dissection." He determined that the recurrents were the true vocal nerves, and showed in one experiment on a dog that the voice could, "when taken away by the division of the nerves, again return." Galen, he tells us, said also that the voice "ought to return after it had been lost by experiment," owing to the communicating branches between the superior and inferior laryngeal nerves, but Haighton believed that it depended upon the reunion of the divided nerves. Magendie (1813), who, up to his day, furnished the most noteworthy experimental work on the larynx and gave a good description of the distribution of the recurrent nerves, believed, nevertheless, that all the muscles which they supplied opened the glottis, while the superior laryngeal nerves, in going to the thyreo-cricoid and transverse muscles, had exactly the opposite function, and closed the glottis. For many years a number of writers blindly followed the teachings of this great physiologist in regard to the functions of the laryngeal nerves and muscles. Hugh Ley, among others, believed with him that the recurrents opened the glottis, and that the transverse muscle was the principal closer of the organ; and in a work of much labor on "Croup"* Ley wrote considerable that is of interest to modern laryngologists, but much also that is most extravagant.

We have mentioned elsewhere† that Magendie was the first who demonstrated experimentally the true action of the thyreo-cricoid muscle; and at the present day, when it is positively known that the office of this muscle in raising the cricoid cartilage on to the thyreoid is to produce longitudinal tension of the vocal bands, we can not read without a smile the reasons which Ley's fertile brain invented to account for this upward movement of the cricoid cartilage. He says he can trace no other purpose for it than that of throwing mucus into, and perhaps through, the chink. "This movement," he continues, "the posterior part of the ring being fixed, while the anterior is carried upward and inward, resembles that of a hoop, which will strike the shin with force when an attempt is made to raise it from its horizontal position by pressure upon its edge with the foot, or that of a basin containing fluid, treading upon the edge of which will throw its contents to a considerable height upon the limb, while the edge of the vessel itself may also strike the shin. The cricoid

* "An Essay on the Laryngismus Stridulus or Croup-like Inspiration of Infants," London, 1836.

† "Experimental Researches on the Tension of the Vocal Bands," "Trans. of the Amer. Laryng. Assoc.," 1883.

cartilage is thus a sort of pail, which, filled from the trachea, empties its contents into or through the glottis, and performs an office somewhat analogous to those scoops or buckets which, attached to a large wheel, help to deepen the river by drawing the earth from its bed, and, by the same revolution of the wheel, discharge their contents into an adjoining lighter for ballast or other purposes."

Here we see one of the most exquisite of the co-ordinated movements of the larynx—a movement upon which one of the fundamental laws of vocal physiology is founded—actually compared to the working of a dredging-machine and a mud-scow!

Hilton, in his "Lectures on Rest and Pain," gives a far more poetical explanation of this upward movement of the cricoid cartilage. In speaking of the motor branch of the superior laryngeal nerve, which supplies the thyreo-cricoid muscle, he says: "No matter how rapidly the nervous influence passes, it must reach the nearest point first, and that is apparently the reason why this little nerve takes so short a course to the crico-thyreoideus. It has long been my habit to regard the crico-thyreoidei as the muscles which are intended to tune the vocal instrument; and, as the instrument must be tuned before it can be played upon, so this nervous influence, first reaching the crico-thyreoidei, the vocal cords are put into a due state of tension, preparatory to the more precise and accurate influence of the other muscles acting directly and indirectly upon the vocal cords."

It was not long, however, before important light was shed upon these questions. Reid (1838), whose paper we have already mentioned, gave an accurate account of the anatomy of the recurrent nerves. He refuted Magendie's statement that these nerves moved only those muscles which opened the glottis; he confirmed experimentally Magendie's views of the action of the thyreo-cricoid muscles, and described the functions of the other intrinsic muscles, as they are now generally understood. He showed also that irritation of the recurrents of a dog closed the glottis.

Three years later (1841) Longet's* well-known paper appeared, which covered very much the same ground as Reid's, with practically the same results. Longet, moreover, agreed with Bischoff† that the internal branch of the spinal accessory was the motor nerve which presided over the tensors and the closers of the glottis, and that the

* "Recherches expérimentales sur les fonctions des nerfs du larynx," etc., "Gaz. méd. de Paris," ix, 1841.

† "Nervii accessorii Willisii anat. et physiol.," Heidelberg, 1832.

dilators were innervated independently. Cl. Bernard's* careful experiments confirm this view. He showed that section of the spinal accessory in a kitten five weeks old was followed by aphonia, but glottic respiration remained free. Two days afterward, the kitten having remained well but voiceless, its recurrents were cut, when it instantly died asphyxiated. He concludes from this that the pneumogastric has a motor power independent of the spinal accessory which permits the animal to breathe after the latter has been cut; or, in other words, the larynx is a vocal organ when excited by the spinal accessory, and a respiratory organ when under the influence of the pneumogastric, or more probably of other motor nerves associated with it. In certain animals, as the chimpanzee, the internal branch of the spinal accessory does not blend with the pneumogastric, but goes direct as a separate nerve to the larynx.

Conclusive as were the experiments of Magendie, Reid, Longet, and others who have followed them, we find, even at the present day, differences of opinion in regard to the offices of certain of the intrinsic laryngeal muscles, about which our knowledge is apparently exact, as their function has been experimentally proved. The salient points of these questions, however, although they will always be more or less at the mercy of theorists, may be considered as tolerably well established. We know that the recurrent nerves supply those muscles which both open and shut the glottis—all of the intrinsic muscles, in fact, except the longitudinal tensors, the thyreo-cricoids; also, in part at least, those muscles which compose the ventricular bands and the ary-epiglottic folds. It is reasonably certain, too, that the internal thyreo-arytenoids, the lateral crico-arytenoids, and the transverse muscles are the closers, while the posterior crico-arytenoids are the only openers of the glottis.

In coming now to the subject-matter of this paper, we wish to express our gratification at having had the other Boston members of this association (Dr. Knight, Dr. Langmaid, and Dr. De Blois) as witnesses to some of the results herein recorded. Our thanks are especially due Dr. J. Solis-Cohen for his interest in this subject, who, with Dr. Edward Martin, of Philadelphia, was willing to submit to a long and tedious journey to pass a day of experimental investigation with us in the laboratory. It has been our object in our present series of observations, as in all our experimental work of the past five years, to multiply largely the experiments and to

* "Fonctions du nerf spinal," etc., "Leçons sur la physiologie et la pathologie du système nerveux," tome ii, Paris, 1858.

record only such as were typical and had been seen by other eyes besides our own. We have pursued this plan in order to eliminate, as far as possible, sources of error, and, as our work has always been undertaken without any preconceived theory to support, or care as to what might or might not happen, provided a fact could be established, we think our mistakes—if mistakes there be—will be due to some fault in our methods rather than in our observation.

In arriving at an appreciation of the physiology of the recurrent laryngeal nerves, it may be well to view them in the light of our knowledge of the functions of the organ over which they preside. We can recognize three distinct functions of the larynx controlled by three distinct groups of muscles, which are all innervated by the recurrent nerves. These wonderful nerve-trunks, therefore, which, as previously stated, are but one millimetre in diameter, contain sets of nerve-fibers as distinct as the functions of the groups of muscles which they supply. Mentioned in the order of their importance to life, these muscular groups and their functions are: (*a*) Those that carry on the respiratory function of the larynx; (*b*) the sphincter group, which serve to close the lumén of the larynx to prevent the entrance of foreign bodies, and play an important part in all expulsive acts, such as coughing, sneezing, retching, vomiting, or defecation, "or in those muscular actions where it is necessary to have the thorax fixed in order to enable the muscles attached to it to act with greater advantage or greater precision" (Lauder Brunton and Cash *); and (*c*) the phonatory muscles.†

The respiratory and the phonatory muscles which are attached to the arytenoid cartilages have diametrically opposite action. The respiratory muscles (the posterior crico-arytenoids) hold the glottis open for the ingress and egress of air, and, on direct stimulation, they open it still wider, while the phonatory muscles, when called into play, close the glottis by approximating the vocal bands. The vocal bands are brought into apposition in the median line of the glottis for sound production by a most delicate co-ordination of automatic muscular action, and not by forcible constriction in the sense with which we apply that word to the sphincter-like working of the mus-

* "The Valvular Action of the Larynx," "Journal of Anatomy and Physiology," vol. xvii.

† It must be recognized, however, that some of the fibers belonging to the group of muscles commonly described as the thyreo-arytenoids may act as sphincters under certain conditions, while at other times they serve purposes of phonation.

cles contained in those portions of the larynx above the vocal bands —namely, in the ary-epiglottic folds and in the ventricular bands.

These functions of the larynx can be watched in the laryngoscopic mirror. If the subject under examination takes a deep inspiration, the glottis will immediately dilate under the increased respiratory stimulus; if a probe or other instrument is passed into the interior of the organ, its walls will instantly shut tightly around it, and reflex coughing or retching will be produced; if a vocal sound is emitted, it will be accompanied by an approximation of the vocal bands. Since the recurrent furnishes these groups of muscles with nerve-force, we must speak of it, like the organ over which it presides, as having three functions, its effect upon the larynx depending upon the particular set of nerve-fibers which are called into action. If the different sets of filaments contained in the trunk of the nerve could be traced to their origin, and there differentiated and separately stimulated, we might undoubtedly produce an opening or a closing of the glottis at will, according to the function of the nerve-fibers operated upon.

But when we experiment with the nerve-trunk itself we find there all the different fibers packed together in a small compass, and on applying a current of electricity to it we can not be positive that we are stimulating all of its component filaments equally and simultaneously. We have no definite knowledge of the numerical or topographical relation between the dilating and the constricting fibers. The fact that a stimulus applied to the recurrent nerve of some animals causes a dilatation of the glottis, while in others, under the same conditions, it produces a closure, and again, in the same animal, at one moment dilatation and at another moment closure, according to circumstances, shows us what a complex nerve we are dealing with, and how great are our difficulties when we attempt to apply results obtained in the lower animals to man.

The most important function of the larynx is that of respiration. The muscles which regulate this vital act are the largest of the intrinsic laryngeal group. They are in ceaseless activity during life, holding the glottis open to permit the passage of air to and from the lungs. Theoretically, we should expect that the nerve-fibers which innervate these muscles would be the most numerous, the most sensitive, and of greater resisting power than all the other individual filaments of the recurrent nerve; and also that any stimulus applied to the nerve would excite a contraction of these muscles, since they are the largest of the laryngeal group, and the most bountifully sup-

plied with nerve-force; but practically we know that this is not universally the case. If, for instance, the recurrent nerves of dogs that are unnarcotized or slightly under the influence of ether, chloroform, chloral, or morphine, are stimulated with the feeblest current of electricity, the first effect noticeable upon the glottis is a vibratory movement of the vocal bands, with a tendency toward closure, which, on gradually increasing the intensity of the stimulus, becomes a firm closure of the glottis through tetanic contraction of the adductor muscles. Now, it is very remarkable that if we irritate the recurrent nerves of a cat under the same conditions, the effect upon the glottis is exactly the opposite. The cat's glottis will dilate instead of closing. Contrary to what we observe in dogs, the earliest effect of a weak stimulus applied to the recurrent nerves of the cat is to produce a vibratory movement of the vocal bands with a tendency toward dilatation, which immediately merges into a rigid dilatation as the strength of the stimulus is increased.

Dr. Douglas Powell,* of London, has drawn our attention to the fact that the same phenomena are not observed in different animals, and he has recorded that in the cat, instead of closure, powerful abduction of the vocal bands was obtained on galvanizing the recurrent nerves.

Our own observations agree with those of Dr. Powell, and we think we may affirm that in the dog the function of the recurrent nerve, under normal conditions, is to close the glottis, while in the cat, under similar conditions, it is to open the glottis. These effects take place whether stimulation be applied to the intact nerves or to their peripheral ends after section. These opposite results in the lower animals render the practical and pertinent question, "*What is the normal function of the recurrent nerve in man?*" difficult to answer until we are able to determine which animal man most resembles, or until we subject him to direct experimentation.

The results of experiments on man have not been entirely satisfactory, but they all point in one direction—viz., that stimuli applied to the nerve close the glottis. We know of but one series of experiments made on man where the recurrent nerve was dissected out and irritated. Dr. W. W. Keen,† of Philadelphia, in 1875 experimented on the recurrent nerve of a criminal recently hanged, in order to determine the question whether a chiasm of the minute

* "Med. Times and Gazette," Dec. 19, 1874, p. 701.

† "Trans. of the College of Physicians of Philadelphia," Third Series, vol. i, 1875.

fibers of the nerve existed. He says that repeated faradization, both with weak and with strong currents, of the left recurrent and left vagus produced decided movements of the left vocal cord only. The character of the movements (adduction or abduction) was not mentioned, but Dr. Keen has recently informed the writer that, although he would not like, at this distance of time, to assert positively that the left cord was adducted, he is as reasonably certain that such was the fact as one can be of a remembered fact after a long interval of time.

The attempts that have been made on the living subject to excite the recurrent nerves through the skin and soft parts of the neck, and to observe the effect upon the glottis through the laryngoscopic mirror, have been crowned with a certain degree of success, and it has always been the adductor muscles that were seen to respond to the stimulation.

Gerhardt,* the earliest investigator in this direction, reached negative or doubtful conclusions. Dr. Pauly, of Posen, and Professor Quincke† employed this percutaneous method to reach the recurrent nerves, and observed that stimulation was followed by complete closure of the glottis. Rossbach,‡ Erb,# and Kaplan ‖ have each determined that it was upon the adductor muscles of the glottis that the electrical stimulation was manifested, but, as the results were not constant, and as it was uncertain whether the effects were of a reflex nature or direct upon the nerve, or perhaps upon the laryngeal muscles themselves, we can not regard these observations as throwing any very clear light upon our present inquiry. It is noteworthy, however, that an opening of the glottis has not been recorded by those who have experimented with the recurrent nerves in this manner; and, from our empirical knowledge of the action of the muscles of the glottis in health and in disease, we consider it reasonably certain that any irritation of the trunk of the recurrent nerve in man would produce a spasm of the glottis and not a dilatation.

Let us now return to the lower animals. We have already said that stimulation of the recurrent nerves of the dog, under normal conditions, *closes*, while excitation of the recurrent nerves of the cat

* Virchow's "Archiv," vol. xxvii, 1863.

† Referred to by Kaplan, "Experimenteller Beitrag zur electrischen Erregbarkeit d. Glottismusculatur," etc. Inaugural Dissertation, Berlin, 1884.

‡ "Monatsschr. für Ohrenheilkunde," etc., October, 1881, No. 10, p. 166.

"Handbuch der Elektrotherapie," Leipsic, 1882, p. 472.

‖ *Loc. cit.*

opens, the glottis. Yet it is in our power, under certain circumstances, to reverse this natural order of phenomena in these two animals, and to produce in the dog a dilatation and in the cat a closure. The sole condition in the dog, so far as our present experience goes, by which a dilatation of the glottis can be obtained, is through the influence of sulphuric ether, and when the animal is in profound morphine narcosis.

From some undiscovered cause ether completely abolishes the offices of the glottis-closers. It has some unknown peripheral effect upon either the laryngeal muscles or nerves, or both, so that when a dog is in profound ether narcosis his glottis no longer closes when the recurrent nerves are stimulated, but, on the contrary, is opened widely through the action of the glottis-openers, upon which ether has, apparently, no influence.

In a paper* entitled "The Respiratory Function of the Human Larynx," published two years ago, we recorded this fact for the first time. From the date of that observation to the present time experimental researches have been prosecuted in the physiological laboratory of the Harvard Medical School, by others as well as by ourselves, with the view of determining the cause of this "ether-effect," and whether sulphuric ether would have analogous effects upon other nerves and upon other groups of antagonistic muscles.

While we were engaged in this direction, having established beyond doubt the *fact* of what for the sake of brevity we shall call the "ether-effect," a paper appeared in the "American Journal of the Medical Sciences," July, 1886, by Dr. F. Donaldson, Jr., wherein the writer stated that he had been unable to obtain the "ether-effect." He did, however, observe a dilatation of a dog's glottis when the animal was under ether, but inferred that the phenomenon was due to weak stimulation of the recurrent nerve instead of to the ether, inasmuch as he produced a closure of the glottis on increasing the intensity of the current.

Shortly after this paper was issued, Felix Semon, M. D., F. R. C. P., and Victor Horsley, B. S., F. R. S.,† published in a lucid report the results of their investigations on this subject, which fully verified our own observations. These authors also state that they were able to obtain dilatation with feeble stimuli, yet they call our attention to

* "New York Medical Journal," July 4, 1885.

† "On an Apparently Peripheral and Differential Action of Ether upon the Laryngeal Muscles," "Brit. Med. Journal," August 23, 1886 p. 405.

the fact, and it is here the practical point, that it was only in those cases in which the animal was not deeply etherized.

The dilatation, it seems to us, should be ascribed to the action of the narcotic.

The strength of the current, however, is a factor in determining whether dilatation or closure is produced, and it is undoubtedly correct that *in certain stages of etherization*, as we shall hereafter demonstrate, abduction may be called forth by a weak stimulus, while a stronger stimulus, with the same amount of ether, will produce the ordinary result of closure. But we think it is impracticable to use strong stimuli in these or other studies in experimental laryngology.

In our investigations on the "ether-effect," conducted two years ago, the intensity of the currents used was always of the feeblest, and it therefore struck us as somewhat extraordinary that others who followed us should lay so much stress upon the fact that weak stimuli should be the cause of the opening of the glottis, which, in reality, as we had proved, was due to the effect of sulphuric ether.

Considering, therefore, the confusion, although it appears to us to be more fancied than real, that has slightly befogged this question, we have felt it incumbent upon us to rehandle the subject.

It may be well here to explain more in detail than we have hitherto done the terms we use to describe the different shapes the glottis may assume in response to electrical stimulation of the recurrent nerves. By *complete dilatation* we mean that both vocal processes of the arytenoid cartilages are rotated forcibly outward, the vocal bands, in marked instances, appearing to lie flat against the walls of the larynx, this extreme opening being maintained as long as the stimulation is kept up. By *mixed movement* we mean an opening in the posterior portion of the glottis and a contraction of the ligamentous portion in front, giving to the glottis a rhomboidal shape. This shape appears to arise in two ways—either by an active opening behind accompanied by an active closure in front, or simply by a *want* of *closure* behind and an active closure in front. The large development of the cartilaginous portion of the glottis in the dog should be borne in mind in interpreting these appearances. The agency by which the mixed movement is brought about is not perfectly understood. It would seem, in some instances, as if all the intrinsic group of muscles were responding equally to the stimulation except the lateral crico-arytenoids and the transversus; hence the closure in front and the opening behind; but, the lateral and trans-

verse muscles not acting, the lozenge-shaped glottis is the result. By *complete closure* we mean close apposition of the ligamentous and cartilaginous portions of the glottis.

When we consider what a complicated and delicate organ the larynx is, being made up of so many cartilages which are freely movable on each other by means of the numerous muscles attached to them, the fibers of which run in every possible direction, it need not cause surprise that there should be occasional variations in the appearances of the glottis in different dogs following stimulation of the recurrents which may be due to some peculiarity of the nerve distribution or to unusnal strength of some of the laryngeal muscles.

But of the general results in dogs we think there is not much ground for doubt or for any difference of opinion of practical value. Errors of interpretation may be lessened and the most trustworthy results obtained by placing a shielded electrode on each nerve five to eight centimetres below the cricoid cartilage, the effect of stimulation on the glottis being watched through the mouth, when both nerves are irritated equally and simultaneously.

Small and young dogs, in our experience, are much more satisfactory for experimental purposes than old or very large ones. The breed seems to be of no consequence.

Our present series of observations have been conducted on forty-two dogs, and comprise three hundred and twelve recorded experiments. Of these animals, twelve have been devoted to a study of the effects on the glottis of stimulating the nerves when the dog was under chloral, chloroform, or morphia, eighteen to the "ether-effect," seven to the local effect of ether upon the nerve-trunk, and five to "exhaustion" experiments.

We have stated that the normal effect of irritating the recurrent nerves of dogs is to *close* the glottis. This statement is founded upon the investigations of others, who have experimented with and without anæsthetics, and upon our own observations with small amounts of different narcotics.

The following experiments with chloral may be taken as a type of what occurs in the majority of cases when dogs are under small amounts of chloral, morphine, chloroform, or ether. These particular experiments are selected from a large number merely because some of our colleagues conducted the observations with us:

April 27, 1887.—Dr. Knight and Dr. Langmaid present. Medium-sized poodle bitch. Ether was first given until the femoral vein was exposed and a cannula tied into it, through which a 25-per-cent. solu-

tion of chloral was slowly injected. After this stage of the operation the animal had no more ether. The recurrent nerves were laid bare, and shielded electrodes placed upon them. The glottis was observed through the mouth. Stimulation of the nerves with the feeblest current was followed by a vibratory motion of the vocal bands, which, on increasing the intensity of the stimulus, passed into complete closure. Nothing resembling a dilatation or the mixed movement could be called forth in this dog.

Dr. Knight was present on another occasion, when a very small terrier bitch was the subject of experiment under similar conditions, and the results were identical in all respects. In no instance, in a chloralized dog, have we been able to elicit a complete dilatation, but the mixed movement has been seen in two cases. In one of these, Dr. Knight, Dr. Langmaid, and Dr. De Blois assisting, the dog was a very powerful animal, and, although the first few effects of stimulation were followed by closure, the mixed movement only was afterward called forth with all intensities. It would seem that this mixed movement was produced through a failure of the lateral crico-arytenoid muscles to respond to electrical stimulation, the other muscles acting equally. It may be that, as narcosis comes on, the lateral adductor is the first to lose its contractility, and, as the narcosis becomes more profound, the functions of the other adductors are also arrested, while the dilators hold out to the last.

Although we have not been able to produce complete dilatation with chloral or chloroform, it is not unlikely that, by pushing these drugs to extreme limits, we might, in certain cases, elicit such an effect. It is difficult to believe that sulphuric ether should be the only drug capable of calling forth abduction. We have succeeded in obtaining complete dilatation in a dog under an enormous dose (2–5 grammes) of morphine; but the condition of the dog under these circumstances can hardly be compared with that of the animal when a harmless dose of ether has been administered. It was with much surprise that, in the spring of 1885, we saw, for the first time, the glottis dilate under the effect of an irritation applied to the recurrent nerve; but we immediately surmised the reason, which subsequent researches by ourselves and others have shown to be correct. It may render this study clearer if we briefly review the circumstances of our first observation, and how we were led to what appeared to us the only possible conclusion, that the dilatation was brought about through the influence of sulphuric ether. Our experiments, which had already been quite numerous, were generally per-

formed on dogs chloralized by intravenous injection. This means of producing anæsthesia was almost invariably employed for prolonged experiments. Ether, however, was given in the first stage of the operation. The dog in which we first observed a dilatation was etherized for the purpose of passing a thread through the recurrent nerve, after which the incision in the neck was to be sewed up, and the animal returned to his kennel for a few days before further observation. On looking for the nerve, it was not found in its proper anatomical situation; but two small nerves were discovered near by. As it was doubtful what these two branches were, it was considered prudent to irritate them, and, if the glottis contracted, we could then be certain we had the nerve we were in search of, and proceed with the operation. But, when the nerves were stimulated, we were greatly surprised to see a forcible dilatation, instead of the customary closure. The assistant in physiology, Dr. Warren, was requested to come and witness this unusual sight. The ether sponge had been removed from the dog since the beginning of the experiment, and by the time Dr. Warren was ready to look at the glottis the animal was somewhat out of its influence. At all events, on stimulating the nerve a second time, closure was manifested, instead of the dilatation so evident a few moments before. Here we had in the same dog, at a short interval, both a dilatation and a closure of the glottis. As all the conditions were the same, with the exception of the depth of the narcosis, the natural inference was that the amount of ether in the animal must be the cause of the dilatation. A large quantity of ether was again administered, and the abduction again clearly demonstrated.

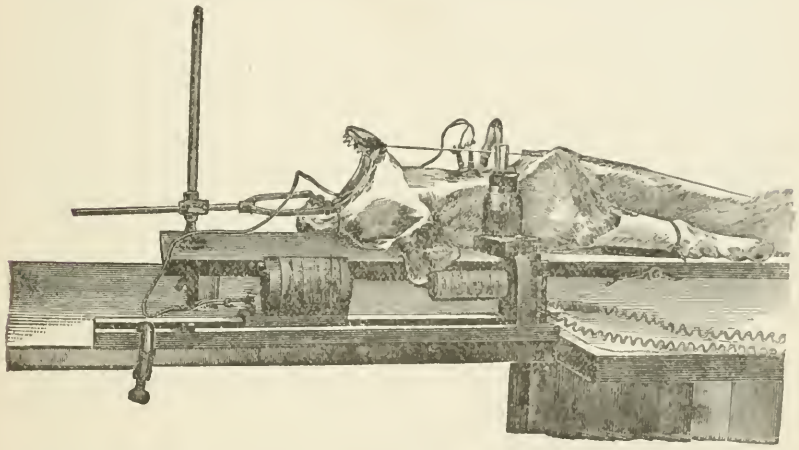
Our first idea was that the "ether-effect" was central. To test this hypothesis the recurrent was divided, and the irritation applied to its peripheral end. The glottis dilated after section of the nerves as well as before.

With regard to the fact of the "ether-effect" in dogs we have little to add. Our previous experiments were based on so many confirmatory observations on different dogs that the fact was clearly established. The facility with which a dilatation may be elicited depends upon the susceptibility of the dog to the drug, the intensity of the irritation, and the amount given. It differs in different dogs. In the majority complete dilatation may be elicited; in other instances the mixed movement only is obtainable. In two dogs, in our experience, the effect has been negative; in these cases there was neither contraction nor dilatation on stimulation of the recurrent

nerves, even in the most profound stage of etherization, but with slight anæsthesia closure took place.

"*Ether-Effect*" *Method.*—The accompanying figure will make our method clear.

The dog is here arranged in what we consider the most satisfactory manner to demonstrate the "ether-effect" in its different aspects. It will be seen that the animal is fixed on his back, with his upper jaw tied to a dog-holder, while the lower jaw is held open by a cord fastened to the lower end of the board. A perfect view of the glottis is now made easy by holding the tongue forward in one hand and lifting the tip of the epiglottis by a long forceps with the other Tracheotomy has been performed, and the tracheal cannula is connected with a bottle containing ether by a short piece of rubber



tubing, which can readily be adjusted to or removed from the cannula. A shielded electrode is upon each recurrent nerve; the electrodes are connected with each other, and in communication with an induction apparatus, which is supplied from one Grove cell in a battery closet. The secondary coil of the apparatus is on a slide, so that it can be moved to and fro at will, according to the intensity desired. It is our custom to begin an experiment with the secondary coil so far removed from the primary that no effect is manifest on the glottis by opening the short-circuit key connected with the secondary coil, and then to slowly approach the secondary coil toward the primary until some effect on the vocal bands is produced. When a dog is very slightly etherized, the first movement noticed of the vocal bands

is of a vibratory character, which changes into a closure of the glottis as the intensity of the current is increased. Now, having determined on a given dog the feeblest stimulation that will provoke a closure of the glottis with the smallest amount of ether, let us attach the ether-bottle to the tracheal cannula, and watch the evolution of the "ether-effect" through the mouth. By irritating the recurrent nerves at intervals of a few moments (the intensity of the current, be it understood, being always the same), the following changes will be noticed as the animal consumes more and more ether: The constrictors soon show signs of failure to respond to stimulation, and, instead of a closure of the glottis, the mixed movement is seen, which in time gives way to complete dilatation when the dog is sufficiently saturated with ether. By now removing the ether at this point of complete dilatation, the reverse picture of the above phenomena can be traced as the animal emerges from profound ether narcosis. The dilatation will soon give way to the mixed movement; this mixed appearance will gradually become less and less until, finally, complete constriction supervenes, when we have returned to the starting-point of the experiment. The ether may now be again administered, and the experiment repeated. Mention has already been made of individual canine peculiarities, some of the animals being very susceptible to ether, while in others the mixed movement only can be demonstrated, no matter how much of the anæsthetic is given. In presenting detailed experiments, we shall select from our note-books the most typical cases, which may be taken as representative of the average dog. The following experiment shows the time it may take to complete the circle of the "ether-effect" when the intensity of the stimulation remains the same as just described.

December 22, 1886.—Smooth-haired mongrel bitch, ten to eleven months old. Arranged for observation as previously described. Intensity of stimulation = 5, which was the feeblest current possible to produce a decided effect upon the vocal bands.

TABLE I.

	Time, A. M.	Result.
Ether applied.	10.15	Contraction.
	10.16	Mixed movement beginning.
	10.17	Mixed movement more marked.
Ether removed.	10.18½	Complete dilatation.
	10.20	Mixed movement.
	10.22	Almost complete contraction.
	10.23	Complete contraction.

It will be noticed that in this particular dog eight minutes were sufficient to exhibit the "ether-effect" in all its stages.

All our animals, we need hardly say, were etherized while being prepared for experimentation, which generally occupied from a half to three quarters of an hour. During that time the dog was given merely enough ether to keep him quiet and free from pain. Some dogs pass very quickly and quietly under the influence of ether, and come out of it with surprising rapidity, while others are very bad etherizers.

We may add another experiment here, like the one just detailed, solely for the sake of comparison, on an older dog than the last and one not quite as susceptible, but the variations are within narrow limits, as has been the case in all similar observations.

December 19, 1886.—Rough-haired terrier bitch, about two years old. Intensity of stimulation = 6, which was the weakest we were able to use, as a feebler current caused merely a vibratory movement of the vocal bands.

TABLE II.

	Time, A. M.	Result.
Ether applied.	11.13	Contraction.
	11.15	Mixed movement.
Ether removed.	11.18	Complete dilatation.
	11.19	Dilatation.
	11.20	Dilatation.
	11.21	Dilatation accompanied by slight vibration.
	11.22	Dilatation less marked; tendency toward mixed movement.
	11.23	Mixed movement.
	11.25	Almost complete contraction; on increasing the intensity of the stimulation at this point very slightly, a complete and vigorous contraction took place.

Leaving the question of the phenomena consequent upon the same stimulus in different stages of etherization, we will pass to a consideration of the effect of weak and strong stimuli rapidly applied in succession to the recurrent nerves, according to the depth of the ether narcosis. For this purpose, let us start with a dog in the most profound state of etherization, at a point where stimulation with currents, from the weakest to the most powerful that it is reasonable to use, will fail to produce a closure of the glottis. When this condition is determined, remove the ether and proceed in the following manner until the experiment is completed: Place the secondary coil so far from the primary that there will be practically no current; then, leaving the short-circuit key open, move the secondary toward

the primary coil at stated intervals, noting the different effects upon the glottis, according to the intensity of the stimulation, as the animal comes out of the ether. It will be found, under these circumstances, that dilatation or the mixed movement with *all* intensities soon gives way to dilatation or the mixed movement with weak stimuli only, and contraction with stronger; and that contraction is called forth by stimuli less and less strong as the dog becomes less and less etherized, until finally contraction only is produced by even the feeblest irritation. We submit the following table, showing in minutes the time it usually takes to demonstrate these phenomena.

November 28, 1886.—Well-bred collie bitch, six to seven months old. Arranged for observation as already described. Profoundly etherized. Ether removed at beginning of experiment, 10.39 A. M. (*a*). The intensity of the irritation necessary to produce the results indicated at the head of each column is shown by the numerals below.

TABLE III.

Time, A. M.	Vibration.	Dilatation.	Mixed.	Closure.
a. 10.39	2	5	22	....
b. 10.40	2	....	9·5	....
c. 10.41	2	...	4·8	....
d. 10.41½	1·5	....	4·8	22
e. 10.42	1·5	....	4·8	9
f. 10.42½	1·5	....	....	4·8
g. 10.43½	1·5	....	....	3

An analysis of this table shows that at the beginning of the experiment (*a*), when the dog was thoroughly saturated with ether, vibrations of the vocal bands were called forth by the excessively weak stimulus of 2; as the secondary coil was moved toward the primary, complete dilatation was manifested at 5, which persisted until the comparatively powerful intensity of 22 was reached, when the mixed movement supervened. No closure of the glottis could be obtained in this stage of etherization, even by the strongest stimulation. One minute later (*b*), the secondary coil being again started at the farthermost point from the primary, vibrations were noticed at the same intensity as before, but dilatation was no longer obtainable, although the ether had been removed but one minute. The mixed movement, however, was seen to occur with a much feebler irritation (9·5). Still no closure. After another minute had elapsed (*c*) the mixed movement was elicited by a still feebler intensity (4·8); otherwise no change. At the next trial (*d*), half a minute later, a marked

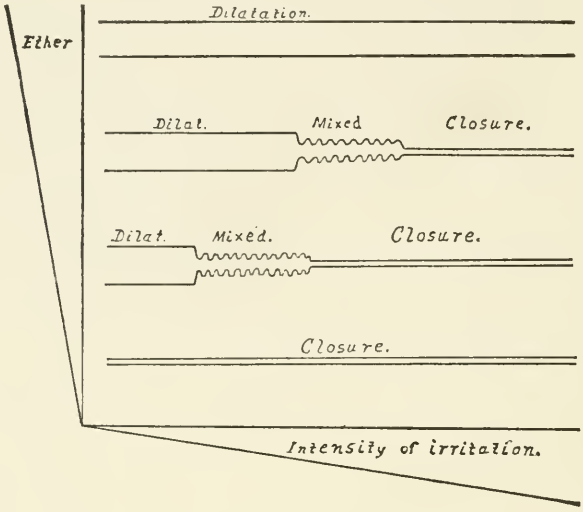
change was observed. The mixed movement remained the same, but vibration took place with a feebler stimulus (1·5), and now, for the first time, closure was effected at 22. Here it will be noticed that closure of the glottis was brought about by the same intensity (22), which two minutes and a half before (*a*) had given rise to the mixed movement, and when it was impossible to close the glottis even with the strongest stimulation. Half a minute later (*e*) closure was produced by a stimulus less than one half as powerful as in the previous trial (*d*). The other conditions remained the same. At the expiration of another thirty seconds, the dog being now pretty well out of his ether (*f*), the mixed movement was no longer manifest, and closure was easily effected by a very feeble irritation (4·8). One minute after this (*g*), the animal having so little ether left in him that he was beginning to struggle, a complete closure was called forth by an intensity of 3. At this point ether was again administered. The duration of the experiment was four minutes and a half from the time (*a*) when a closure was impossible with the strongest stimulus to (*g*) when closure took place with an excessively weak stimulus.

The foregoing method of watching the "ether-effect" is very conclusive. The experiment may be repeated on the same dog several times with almost mathematical precision, and it has been a source of surprise to us that there should be so little variation in the transitional stages of the phenomena, even in the same dog; but it is quite natural that there should be differences in different dogs. The differences, however, are only in the *length of time* necessary to bring out the phenomena with ether, not in the character of the phenomena themselves. We have devoted eighteen separate dogs to the study of this particular question of the effects of intensity of varying strengths, according to the amount of ether in the animal, and the results on a susceptible dog are identical—namely, dilatation of the glottis is obtained with *all* intensities when the dog is profoundly etherized; but as there is less and less ether in the animal, dilatation is obtained *pari passu* by weaker and weaker stimuli and closure by stronger, until the normal closure is effected by *all* intensities when the dog is very slightly under the influence of the drug.

The "ether-effect" may be represented diagrammatically as shown in the diagram on page 70.

The converging lines on the left represent the amount of ether, which diminishes from above downward. The diverging lines at the bottom of the diagram, as read from left to right, indicate the

increase in the intensity of the irritation. Starting now at the bottom of the diagram with a very small amount of ether, the two parallel lines close together indicate a closure of the glottis with all



intensities. Going a trifle higher, we find with a larger amount of ether dilatation takes place with weak stimuli, which changes into the mixed movement as the intensity of irritation is increased and finally closure supervenes. The same general effect noted directly above is observed with a larger amount of ether, only the dilatation and the mixed movement do not give way so early to complete closure as the intensity is increased. Finally, with a full amount of ether, dilatation is elicited with all intensities.

Shortly after our first observations were published (autumn of 1885 and spring of 1886) Mr. J. W. Perkins, interne at the Children's Hospital, Boston, and Dr. F. W. Ellis undertook a series of investigations on the sciatic nerve of the frog in order to decide whether similar peripheral "ether-effects" could be elicited from this nerve, which, like the recurrent laryngeal, supplies groups of antagonistic muscles. The results of these observers have been embodied in a paper by Professor Bowditch, entitled "The Action of Sulphuric Ether on the Peripheral Nervous System," which may be found in the "American Journal of the Medical Sciences" for April, 1887. We must refer those interested in this question to the original paper for the details of the results of the experiments,

for we shall quote here only such portions as are of importance in connection with our present study of the recurrent nerves, and which led to fresh experiments on our part. Perkins and Ellis found that stimulation of the sciatic nerve of the frog, treated by various methods with ether, produced opposite effects from those without ether. It was determined also that similar to the experiments on the recurrent nerve, the "ether-effect" was at the periphery, and from a study of the question, whether it was upon the nerve-trunks, the nerve terminations, or the muscular fibers, Professor Bowditch concludes that, as far as the sciatic nerve of the frog is concerned, the "ether-effect" is a phenomenon dependent upon the action of the drug upon the nerve-trunk, and that it exercises an elective and paralyzing action upon certain of the nerve-fibers. This explanation, however, of the "ether-effect" being a partial paralysis of the nerve-fibers, although justified from the studies on the sciatic nerve of the frog, is not applicable to the action of the drug on the recurrent nerves of the dog. Perkins and Ellis observed the "ether-effect" in the frog by applying the drug locally to the sciatic nerve. We determined, therefore, to pursue the same line of research in the dog. For this purpose chloralized dogs were used. Now, if the cause of the "ether-effect" resided in the nerve-fibers themselves, we might expect to obtain a dilatation of the glottis by subjecting the trunk of the recurrent to the local action of the drug. This procedure was accomplished by attaching a gutter to the shielded electrode, into which a solution of ether could be dropped directly on to the nerve-trunk, the effects on the glottis being watched through the mouth while stimulations were applied to the nerve below the point where the ether was working its local action. We have tested this local effect of ether on seven dogs without being able in a single experiment to obtain a dilatation. A six-per-cent. solution of ether was generally used. This was found to gradually paralyze the nerve in from two to six minutes, according to the dog. It was observed also that when a nerve had become paralyzed in this manner and was afterward washed with a half-per-cent. solution of salt, the vocal band would in a few minutes regain its mobility. The shortest time that it took the vocal band to recover its motion was seven minutes and the longest twenty-two minutes. The only result of the stimulations of the recurrent nerve in chloralized dogs which had been subjected to the local action of ether was that, as the nerve became more and more paralyzed, it required a stronger and stronger stimulus to cause a contraction of the corresponding vocal band.

Abduction was never obtained. We will describe one experiment in detail to show the different steps in the operations.

Table IV.

Time, A.M.	Intensity of irritation.	Results.	Remarks.
10.43....	2½	Contraction.	6% solution of ether applied locally to right recurrent nerve.
10.44....	2½	"	
10.45½...	2½	Contraction less vigorous; right vocal band paralyzed.	
10.46....	2½	Contraction feeble.	Necessary to increase intensity of stimulation.
10.47....	5½–7	Vibration, contraction.	
10.48....	5½–8	" "	
10.49....	7½–10	" "	
10.50....	9½–13	" "	
10.51....	10–15	" "	
10.52....	10–15	" "	More chloral given.
10.58....	12–18	" "	More ether on nerve.
11.01½...	12–20	" "	
11.03....	13–20	" "	
11.05....	15–25	" "	Contractions very feeble indeed; electrode changed to left recurrent; right recurrent washed with salt solution.
11.12....	....		Right vocal band has recovered its respiratory movements.
11.12½...	0·7–1	Vibration, contraction.	Stimulation of left recurrent; more chloral given.
11.18....	....		Ether locally on left recurrent.
11.18½...	0·7–1	Vibration, contraction.	
11.19½...	0·7–1	" "	
11.22....	7½–9	Vibration, contraction; left vocal band paralyzed.	
11.23....	7½–9	Vibration, contraction.	
11.24½...	7½–10	" "	More ether on nerve.
11.31....	9–12	" "	
11.34....	9–13	" "	More ether on nerve.
11.39....	10–15	" "	
11.40....	10–15	" "	Contractions very feeble.

January 27, 1887.—Collie dog, six months old. Ether was first administered. It was ascertained that the dog was most susceptible to the drug, and complete dilatation was obtained. The ether was now removed. The femoral vein was exposed and a cannula tied into it. Through this a twenty-five per cent. solution of chloral was slowly injected until the animal was thoroughly under its influence. The feeblest stimulus was then determined, which would produce a contraction of the glottis. This proved to be $I = 2\frac{1}{2}$ for the right side and $I = 1$ for the left; anything weaker caused merely a vibra-

tory movement of the vocal bands. The results were as shown in Table IV.

It will be seen by this table that there was a slight difference in the behavior of the two nerves. Although the excessively weak stimulus of $2\frac{1}{2}$ (which was so feeble that it could not be perceived by placing the wires on the end of one's tongue) called forth a contraction of the right vocal band, the left responded to a still weaker current. We have not infrequently noticed a difference in this respect between the two nerves, and presume the condition of the electrodes or some slight accident in the preparation of the nerves, or the completeness with which they were freed from the connective tissue surrounding them, may account for it. But the general results were identical. Each nerve became paralyzed in from two and a half to four minutes, and, as the paralysis was more complete, it needed a more powerful stimulus to produce contraction. As before mentioned, not a trace of dilatation could be obtained. In order to show how different dogs may be affected as regards the details, though in the main the results agree perfectly, we will add here another experiment:

January 20, 1887.—Rough-haired mongrel dog, about nine months of age. Not very susceptible to ether, as the mixed movement only could be obtained. Dog chloralized.

Table V.

Time, A.M.	Intensity of irritation.	Results.	Remarks.
11.07....	2–3	Vibration, contraction.	6% solution locally on right nerve.
11.09½...	2–3	" "	
11.13....	150	Right nerve paralyzed, and only responds to this very powerful irritation.	
11.16....	....		Right nerve washed with salt solution.
11.23....	....		Electrode changed to left recurrent.
11.27....	3	Contraction.	6% ether locally on left recurrent.
11.28½...	3	"	
11.29½...	3	C'ntract'ns less mark'd; vocal band becoming paralyzed.	
11.30½...	....		Left nerve paralyzed.
11.31....	80	Slight contraction.	
11.33....	80–150	Vibration, slight contraction.	
11.35....	....		Respiratory movements of right vocal band just reappeared.

In this dog the right vocal band became paralyzed in six minutes, and did not respond to any stimulus short of the very powerful one of 150. It regained its mobility in twenty-two minutes, and after this it responded as before (not included in the table) to weak stimuli. It will be understood that the differences are only in time and in the strength of the irritation necessary to produce the salient points in these experiments. The results were very constant and show, we think, that the cause of the "ether-effect" in dogs need not be sought in the nerve-trunks.

We have also tested the local effect of ether on the nerve-trunk when the animal was under the constitutional influence of the drug. The only noticeable effect under these circumstances was that as the nerve became paralyzed it required a stronger and stronger stimulus to produce the dilatation.

We endeavored to determine the relative strength and endurance of the dilating and closing nerve-fibers by a series of "exhaustion" experiments conducted by applying a continuous stimulation to the recurrent trunks of dogs when the animals were under the influence of different drugs with the view of converting, if possible, the dilatation of ether into a closure by exhaustion of the abductor fibers, or changing the contraction of chloral into dilatation by exhaustion of the closing fibers. Our researches in this direction showed that it was not possible to produce a change of this sort as a result of fatigue. In no instance was dilatation changed into closure or closure into dilatation by long-continued irritation of the nerves. Continuous stimulation was kept up in different experiments for from ten to thirty minutes without altering the first effect. When the animal was kept in the same stage of etherization, dilatation lasted as long as the stimulation was maintained, while in chloralized dogs the normal closure showed no signs of weakening. In these observations the animals were tracheotomized and the weakest intensity used that was capable of causing a well-marked effect upon the glottis.

We must here leave this subject of the action of sulphuric ether upon the laryngeal muscles of dogs with the regret that we have no explanation to offer why the glottis should dilate under its influence and contract without it. We are inclined to doubt if much light will be thrown upon the cause of the phenomenon by experimental studies on the nerve-trunks themselves such as we have instituted. The secret resides more likely in some histological or chemical difference between the opening and closing muscles of the glottis, and researches in this direction may, we trust, furnish the explanation.

In coming now to our experiments on the cat, we shall find that the normal action of its recurrent nerves is to produce an opening of the glottis instead of a closure, as in the dog. We are at a loss to account for this difference in these two animals of allied genera. Of the animals we have used for experimental purposes—namely, dogs, cats, pigs, and the horse—the cat is the only one in which dilatation of the glottis is the rule under what may be called normal conditions. We can not speak, therefore, of the "ether-effect" in the cat, since abduction takes place equally well under chloral, chloroform, morphine, or ether.

The cat may be arranged for observation in a manner similar to that we have employed for dogs. The larynx of the cat is of a much more delicate pattern than the dog's, and the vocal bands are longer and more flexible in proportion to the size of the animal.

In the living cat dilatation of the glottis is the rule, when its recurrent or pneumogastric nerves are stimulated, or their peripheral ends after section. The mixed movement, however, is sometimes observed, oftentimes at the end of an experiment, when at the beginning no contraction of either the internal or lateral muscles could be detected. But after the cat is dead the effects change. The abductions grow gradually more feeble, while the closure of the ligamentous portion of the glottis becomes more marked, until finally closure only is elicited. This difference between the action of the recurrent nerves on the glottis in the living and dead cat suggested that the condition of the blood might play a part in the phenomena, and we consequently tried the effect of asphyxiating the animal in order to see if we could bring about a closure by the deprivation of oxygen. For this purpose the cat was tracheotomized and allowed to breathe into a small rubber bag attached by a short piece of tubing to the tracheal cannula. As asphyxia was being produced the recurrents were stimulated from time to time, but dilatation was invariably called forth even when the cyanosis was extreme and after the respirations had ceased. In our experience with the living cat we have been able to produce a contraction of the vocal band by but one method, and that reflexly through the pneumogastric nerve. By dividing one of the pneumogastrics about the middle of the neck and stimulating the cut end nearest the brain (care being taken not to include the sympathetic), stoppage of the respiration will occur and the vocal band of the opposite side will come to a standstill in the position of expiration; on increasing the intensity of the irritation a decided contraction of the vocal band will take place, it

coming in contact sometimes with its fellow. The results of our observations, which have been made on twelve cats, were quite constant, the differences being not in the character of the phenomena, but, as in all experiments on different larynges, in the extent or degree to which the effects are manifested. We subjoin the details of specimen experiments:

February 17, 1887.—Male cat. Etherized; secured on its back with mouth held open; glottis observed through the mouth; pneumogastric and recurrent nerves laid bare; irritation of the trunks of both nerves with stimuli of varying strengths produced dilatation of the glottis; same effect followed stimulation of the peripheral ends of pneumogastrics and recurrents after section.

Solution of chloral injected into external jugular vein; stimulation of peripheral cut ends of both recurrents with all intensities produced dilatation.

February 20, 1887.—Male cat. Chloroform first given, afterward chloral. Experiments of February 17th repeated with like results. Left vocal band became paralyzed from some unknown cause. In twenty minutes it began to regain its mobility, the left recurrent meanwhile having been washed with a half-per-cent. salt solution; medulla destroyed; stimulation of cut recurrents immediately afterward gave dilatation.

February 22, 1887.—Male cat. Tracheotomized; ether given through tracheal cannula; stimulation of uncut pneumogastrics and recurrents followed by dilatation; left pneumogastric cut; stimulation of its central end causes a contraction of the right vocal band. Toward the end of the experiments on this animal it was noticed that complete dilatation had given place to the "mixed" movement, there being well-marked contraction of the anterior portions of the vocal bands.

February 24, 1887.—Female cat. Chloroform, later chloral; stimulation of uncut pneumogastrics and recurrents as in previous experiments; mixed movement was observed to follow dilatation after the nerves had been irritated many times; left pneumogastric cut; irritation of its central end produced stoppage of the respiration, the vocal band on the opposite side (the right) coming to a standstill in the median line.

This cat died suddenly without apparent cause; immediately after death, stimulation of the recurrents produced the mixed movement as before; the abductions, however, soon grew very feeble, and in twenty minutes were no longer elicited by stimu-

lating the nerves, while the contractions were still noticed, though less vigorous.

February 27, 1887.—Male cat. Killed at 10.45 A. M.; a few moments later dilatation was called forth by feeble stimuli applied to the pneumogastric and recurrent nerves; the recurrent nerves were now stimulated alternately. At 10.55 irritation of the left recurrent with weak currents produced the mixed movement, which was replaced by complete contraction on increasing the intensity of the stimulus. After this no sign of abduction could be detected, and by 11.15 the contractions had also ceased to be manifested even by the strongest irritations. Stimulation of the right recurrent at 11 produced abduction, which changed into the mixed movement on increasing the intensity of the stimulus. At 11.10 abduction had disappeared; feeble irritation caused slight contraction, which became very marked as the intensity was increased. At 11.20 only very powerful stimuli (100 to 150) produced feeble contraction as the nerve was practically exhausted. The closure after death is more marked in some cats than in others, but the difference from the dilatation during life, with one exception, has been very striking.

This one exception was observed in a cat that had been the subject of one of our asphyxia experiments, and, as the failure to contract occurred on one side only, it may be put down to some accidental cause.

April 15, 1887.—Asphyxia experiment. Female cat. Ether, afterward chloral; tracheotomized; small rubber bag attached by a piece of tubing to tracheal cannula; asphyxia begun at

10.40 A. M. Stimulation of left recurrent produced abduction of left vocal band.

10.42. Respirations fast and violent; tongue and mucous membrane of mouth becoming blue; abduction.

10.45. Respirations much slower; cyanosis extreme; abduction.

10.46. Respirations have almost ceased; abduction.

10.46½. Respirations have ceased; bag removed; glottis is tightly closed, which, when asphyxia was coming on, was widely open; stimulation of left recurrent, as before, caused dilatation of the left vocal band; in a moment or two the cat's normal respirations recommenced; a few minutes later this experiment was repeated.

10.52. Asphyxia begun; stimulation of left recurrent; abduction.

10.53. Respirations 84 to the minute; abduction.

10.54. Respirations much slower; cyanosis extreme; abduction.

10.55. Respirations have ceased; glottis closed; feeble irritation

failed to produce abduction as in the previous experiment; on increasing the intensity a slight opening was observed; artificial respiration was used to resuscitate the animal without success, and the cat may be said to have died at 10.55. We then proceeded to obtain the closure after death, as in previous cats.

10.59. Glottis no longer shut; the vocal bands appear to be a little nearer the median line than the cadaveric position; stimulation of left recurrent gave contraction in anterior portion of vocal band and dilatation of the posterior part (mixed movement).

11.06. The same.

11.09. The same.

11.11. The contraction not so marked; dilatation as before.

11.13. Dilatation; no contraction noticed even on increasing the intensity of the stimulation.

11.16. Feeble dilatation.

11.18. Very feeble dilatation, practically gone.

11.20. Electrode changed to right recurrent; stimulation with feeble and strong stimuli produced contraction; no sign of abduction; the contractions grew gradually feebler, but were elicited for twenty minutes, when the nerve became completely exhausted.

April 17th.—Large male cat; chloralized; irritation of recurrents produced complete dilatation; tracheotomized and arranged for asphyxiation as in previous experiments.

11.05 A. M. Asphyxia begun; abduction.

11.07. Respirations rapid; cyanosis beginning; abduction.

11.09. Respirations about the same; cyanosis marked; abduction.

11.11. Respirations slow; glottis open; extreme cyanosis; abduction.

11.11½. Respiration has ceased; bag removed; glottis closed; abduction; artificial respiration restored the normal respiratory movements in a few moments; this experiment was repeated three times on this animal with like results.

Experiment IV.—Cat breathing naturally; stimulation of recurrents and vagi produce abduction; left vagus and left sympathetic cut; stimulation of central end of vagus stops the respiratory movements, the vocal band of the opposite side (the right) stopping in the expiratory position. On increasing the intensity of the irritation, the contraction of the right vocal band was very marked, the right arytenoid cartilage coming sharply against the left.*

* Stimulation of the central end of the sympathetic increased the respiratory and heart-movements, and produced a great fluttering of the right vocal band,

Experiment XXI.—12.08. Medulla destroyed; stimulation applied alternately to recurrents gave abduction.

12.14. Mixed movement; decided contraction of the anterior portions of the vocal bands, which was not noticeable before death.

12.20. The same.

12.25. Contraction in front; abduction behind very feeble.

12.30. Contraction both sides marked; abduction of right practically gone; of left very feeble.

12.35. Abduction entirely gone; feeble contraction still called forth with strong stimuli.

We may summarize the experimental results of this paper as follows: 1. The recurrent laryngeal nerves are purely motor in their function. 2. Their action upon the glottis differs in different animals. 3. In the dog their normal action is to close, while in the cat they open, the glottis. 4. In the dog, sulphuric ether and huge doses of morphine reverse the normal action of the recurrent nerves; the glottis, under the influence of these drugs, dilates instead of closing on stimulation of the recurrents. 5. The "ether-effect" varies according to the susceptibility of the dog, to the amount of the drug consumed, and to the intensity of the irritation. 6 Under small doses of ether, stimulation produces in dogs two effects upon the glottis, (1) vibration; (2) closure. Under larger doses, according to the intensity of the irritation, four effects may be observed: (1) vibration; (2) complete dilatation; (3) mixed movement; (4) closure. 7. Under very large doses of ether, closure, in certain dogs, can not be obtained with any intensity. 8. Under small doses of chloral, chloroform, and morphine, stimulation of the recurrent nerves of dogs is followed by the same results as under small doses of ether, namely: (1) vibration; (2) closure. 9. The mixed movement is occasionally seen in dogs when narcotics other than ether are given in large doses. 10. In the cat death reverses the normal action of the recurrent nerves. In from five to twenty minutes after death, stimulation causes a contraction of the glottis, while in the living cat dilatation is produced.

which was apparently due to the respiratory efforts. The vocal band was forcibly abducted, but did not remain fixed; it kept "fluttering" in and out, but the outward movements were the more pronounced.

Paper.

FURTHER RESEARCHES UPON THE PHYSIOLOGY OF THE RECURRENT LARYNGEAL NERVE.

By FRANK DONALDSON, Jr., B. A., M. D.

IN a paper read before the American Laryngological Association, in June, 1886, I related a series of experiments undertaken to test the accuracy of some work by Hooper, of Boston, on the respiratory function of the human larynx, the results of which had been given to the society the year previous.

My own conclusions differed widely from his. This present article deals with a further series of experiments upon this important question, which were this time performed to test the accuracy *of my own observations.*

The following statements will be found ("American Journal of the Medical Sciences," July, 1886, p. 96) in the body of my article: "My experiments were undertaken to test the following points:

"1. Is it true that the constrictors (of the larynx) cease to act during *profound* narcosis, or when *consciousness* is *suspended* from any cause?

"2. Do we, as Hooper says, *always* get *abduction* of the arytenoids (dilatation of the glottis) on stimulation of the recurrent nerves, when *consciousness* is *suspended?*"

I would call special attention to the wording of these sentences, for it (the wording) has an important bearing upon the chief points of this paper.

Again (p. 100, *ibid.*): "*My* conclusions from my *first* series of experiments are:

"1. That the constrictor muscles of the larynx *do not cease to act during profound narcosis, or during suspension of consciousness* from any cause, or, in other words, that their action is not dependent upon volition in the sense that they *lose their power* with the loss of volition.

"2. That we do not *always* obtain abduction of the arytenoids when *consciousness* is suspended."

From my *second* series of experiments I concluded (*ibid.*, p. 100):

1. That the *abduction* obtained was not reflex.

2. That *abduction* was in no way dependent upon the *unconsciousness* of the animal, as held by Hooper.

3 (and most important in view of my later experiments). That it was with weak stimuli *only* that *abduction* of the cords took place, which movement of *abduction* gradually passed into one of *adduction* as the strength of the stimulus was increased.

4. That this result *invariably* followed, whether the animal was *slightly*, *deeply*, or *thoroughly* narcotized, whether the animal was *eupnœic* or *apnœic*, when the dog had had his *medulla destroyed*, and after *local death* had taken place.

5. That the rate of stimulation did *not* affect the general result.

6. That, after strong and constant stimulation, the *abductor* muscles became worn out, and ceased to answer to stimuli.

7. That in apnœa the cords came nearer the middle line, the abductors receiving no stimulus in this condition from the respiratory center; and, finally, that,

In the first series of experiments, *adduction* resulted under all conditions of *unconsciousness*;* in the second, *abduction* in all conditions of *consciousness* or *deep narcotism*, provided the stimulus was weak.

In the discussion which followed the reading of my paper Dr. Hooper used the following language, to which I would call special attention. Hooper said:

"Dr. Donaldson had laid great stress on what he called his (Dr. Hooper's) theory of the innervation of the larynx. He was not aware before that he had had a theory on the subject.

"In his paper he had detailed the results obtained from certain experiments, and, in passing, offered, more as a suggestion than anything else, that they might be explained in a certain way. The reader had expressed agreement with him in one point in which he least expected support,† and had disagreed with him upon *points that admitted of no doubt* (the Italics are mine), and were so firmly established by repeated experiments that he was convinced that the reason Dr. Donaldson had *failed* to confirm his (Hooper's) observations was due to some *error in his method* of *experimentation*.

"The phenomena which Dr. Donaldson's (perhaps) hasty experiments had failed to show him could be demonstrated with ease, and repeated as often as might be desired. He understood with regret that Dr. Donaldson's paper was to appear in the July number of the 'American Journal

* The stimulus used was very strong.

† On further experiment, I am forced to change my opinion on this point (the supposed proclivity of the abductor fibers to disease), and I now agree with *Semon and Horsley*.

of the Medical Sciences,' *since it contained so many statements which were inaccurate.*" (The Italics are mine.)*

So much for Dr. Hooper's criticism of my experiments. It will now be necessary to give in detail the chief arguments of his paper, and afterward the conclusions which he draws from his experiments. Hooper says (p. 13, "Transactions" of this society, June, 1885):

"It is a familiar fact to all that, if anything other than air finds its way into the larynx, it produces, through reflex action, a sudden closure of the glottis. It is equally certain that, under normal conditions, the same contraction of the laryngeal muscles may be instantly called forth by direct stimulation of one or both of the recurrent nerves. Now, it may with reason be asked, How is it that this constricting action of the phonatory muscles is brought about, if it be true that the nerve fibers animating the dilators of the glottis are the stronger and the more numerous? Why should we not get *ab*duction of the vocal bands, instead of *ad*duction, on irritating the recurrent nerves? The phonatory muscles are to the respiratory muscles as five to two, and the closure of the glottis has always been ascribed to the superior numerical strength of these constrictors. Yet if we compare, bulk for bulk, the muscular fibers which compose the five muscles of phonation with those of the two respiratory muscles, we do not find that they are much, if any, in excess of the latter, and we venture to think that there is some other factor concerned in this phenomenon apart from mere muscular force. It may be sought, perhaps, in this important difference between the respiratory and the phonatory function of the glottis—namely, that while the respiratory muscles are ever on the alert, holding the glottis open during the entire life of an individual, in his waking as well as in his sleeping hours, *the phonatory muscles, on the other hand, are more dependent upon the consciousness of the individual in order to respond to any irritation.* To explain: The phonatory function of the phonatory muscles could, as far as life is concerned, be dispensed with. Not so their constricting action with the view of excluding the passage of foreign bodies to the lungs. The constrictor muscles of the larynx are the sentinels that guard the approach to these vital organs. But *they cease to act if the animal is in profound narcosis;* † they are asleep, so to speak, on their watch. A man in the condition known as 'dead drunk,' lying, let us suppose, with his mouth open, would offer no obstacle to prevent any living insect that chanced his way from crawling in and out his mouth, or meandering around in his larynx *à volonté*, without exciting reflex contractions of its muscles. The power of ether, chloroform, and other anæsthetics to im-

* I should add that I (with others) put a wrong construction on *two* sentences in Hooper's paper; but this did not in the least affect the value of my observations.

† The Italics throughout are mine.

pair the action of these constrictors is too well known to need mention. To carry this line of thought a little further should we not expect that, provided we could preserve the organic life of an animal while its *volition was at the same time completely abolished*—should we not expect, we ask, under these circumstances, to get a *dilatation* of the glottis on irritating the recurrent nerves instead of a closure, for the posterior crico arytenoid muscles are muscles of organic life? *Indeed, we believe we should*, and *we submit the following experiments in support of that belief.*"

Again (p. 16 of "Transactions") Hooper says, after describing an "unexpected *abduction*":

"On the assumption that the *degree* to which the animal was *narcotized* might have something to do with these phenomena, a larger quantity of ether was administered, and, after the dog was profoundly under its influence, *abduction* of the vocal band was obtained. On removing the ether, the abduction became less and less as the animal *regained consciousness*, when finally a contraction of the glottis supervened.

"Again, the intensity of the stimulus used 'was from 1 to 8, never over 10, and generally about 3'" (p. 17, *ibid.*).

Briefly, from his series of experiments, he concluded:

"1. That the *constrictor* functions of the larynx are dependent upon *consciousness*. (See above.)

"2. That stimulation of the recurrent nerve always produces *abduction*, provided the animal is deeply under ether; that, on removing the anæsthetic, the dilatation produced by stimulation becomes less and less as the animal *regains consciousness*, until, finally, *contraction* of the glottis follows."

In other words, Hooper concluded that the tendency of the glottis was to remain widely open, and that any given stimulus from the recurrent nerve would bring the *abductors* into action, unless *volition* (*the will*) came into play, when it would produce *adduction*.

Finally, on page 17, near the bottom, he says (the Italics are mine):

"These phenomena were observed *after the recurrent nerve had been cut* and its peripheral end stimulated, as well as when the nerve was intact," and "irritation of the recurrent nerve was followed by the *usual* abduction of the vocal band, an action (page 18) we have become accustomed to as regard the normal, *provided* the *consciousness* of the animal had been *completely abolished* by sulphuric ether."

Now, the points in Hooper's paper to which I would direct attention are:

1. In no place in his whole article does he *once* allude to any *peripheral* effect of *ether* on the laryngeal muscles.

2. The abduction obtained by him was in every case attributed to *suspension of consciousness* (see statements quoted above), and not to *any peripheral effect* of that drug.

3. He distinctly states that he got his result on stimulation of both the *cut* and *uncut* nerve.

4. He failed to see that *by the cutting* of the *nerve he once and for ever suspended consciousness* for the *larynx*, and that no amount of ether could suspend it further. He failed to see that any effect following its administration must of necessity have been a *peripheral one.*

And therefore Hooper's conclusion on page 18—that *abduction* was *normal provided consciousness* was *abolished*—was as extraordinary as it was unjustified and unscientific.

In this connection, Semon and Horsley say * that it was remarkable that Hooper should have overlooked this *peripheral* effect of ether, for he got his results with the nerve *cut* as well as uncut.

That Hooper was dealing with a peripheral effect, *though he thought it central*,† even after he had *cut* the nerve, and no impulse could get to the larynx from the cortex, is noticed, too, by H. P. Bowditch, in an article ‡ in the "American Journal of the Medical Sciences" for April, 1887, and upon this point he lets Hooper down very gently, thus:

"Dr. Hooper recorded the observation that stimulation of the recurrent nerves of dogs causes a dilatation of the glottis when the animals are thoroughly etherized, but a constriction when they are slightly or not at all under the influence of the drug.

"As the *phenomena* (*abduction*) *occurred equally well whether* the *stimulation was applied* to *the intact nerve* or *to its peripheral end after section*, it was *evident* that the action of the drug must be either upon the *peripheral* portions of the nerve or upon the muscles." (The Italics are mine.)

Dr. Bowditch says: "It was evident." It could not have been to Hooper, for he makes not the slightest reference to any such fact,

* "On an Apparently Peripheral and Differential Effect of Ether upon the Laryngeal Muscles," "British Med Association," 1886.

† We can not give any greater proof of this fact than his statement on page 18—viz.: "Just in proportion as *consciousness* was *deadened* the adductors became sluggish," and so on.

‡ "The Action of Sulphuric Ether on the Peripheral Nervous System."

invariably attributing his abduction to *suspension of consciousness.* Again, Hooper says the stimulus he used was generally at 3. I am now in a position to state that in ninety-nine cases out of a hundred any stimulus having the strength of 3 will always give *adduction* of the vocal cords.

But to return to Dr. Bowditch's paper. On page 453 he says:

"Donaldson, though unable to obtain the ether effect, did observe a dilatation of the glottis when the recurrent nerve was irritated with *very weak* stimuli."

Now, there is not one word in my paper on the "ether effect." I was combating Hooper's "consciousness theory," and endeavoring to get at the physiology of the recurrent nerve; I was *not* investigating the *peripheral* effect of *ether.* I stated very plainly that *whether* the animal was narcotized or not, whether it was alive or dead (locally), the *opening* or the *closing of the glottis depended* upon the *strength* of the *stimulus.*

I do not for one moment deny that ether does *prolong* abduction and in many cases does away with all adduction; this statement is confirmed by the experiments about to be related. But there are several statements in Dr. Bowditch's paper (which, however, I take it, are to be credited to Hooper, as he is quoted as part author), and these I desire to greatly emphasize (the Italics are mine):

1. "It has not been found possible in these experiments [done by Hooper, I suppose he means] to obtain a *dilatation* of the glottis by *any* stimulation of the recurrent nerve *unless* the animal was under ether."

2. "When the animal is etherized, the effect of irritating the nerve varies with the depth of the narcosis and strength of the stimulus."

3. "If the animal is thoroughly under the influence of the drug, *dilatation* of the glottis is *produced* by *irritations* of *all* intensities."

4. "The observation of Donaldson, that dilatation is produced by feeble, and contraction by strong, stimuli, is therefore correct for a *certain stage* of etherization, but for the *unetherized* animal *his statement has not been confirmed.* . . . In view of *Hooper's*" (the Italics are mine) "failure to obtain dilatation on *unetherized dogs, it seems probable* that in *Donaldson's cases* the drug had not *been completely eliminated.*" (*Ibid.*, pp. 453, 454.)

Before passing to my present series of experiments, I would say that, with due deference to the Boston observers, they have somewhat shifted their ground. Not a reference is made to the rôle which Hooper said *consciousness* played in the closing of the larynx, and a great deal on the peripheral effect of ether, to which Hooper,

in the paper I originally criticised, made no allusion, and which, indeed, he entirely *failed* to *notice.*

To recapitulate, Hooper says, then:

First. That *adduction* was dependent upon *consciousness.*

Second. That *abduction* can not be obtained from *any* stimulus *without* giving ether.

Third. That my statement (see Dr. Bowditch's paper, page 453) as to the effect of weak and strong stimuli is *not true* except with ether.

Fourth. *That my original paper is full of inaccuracies.*

So much for what Hooper says.

He does *not* say a word about the *peripheral effect* of ether, though he had *cut* the *nerve*, and it was plainly what he was dealing with.

To pass, now, to my present series of experiments, which prove:

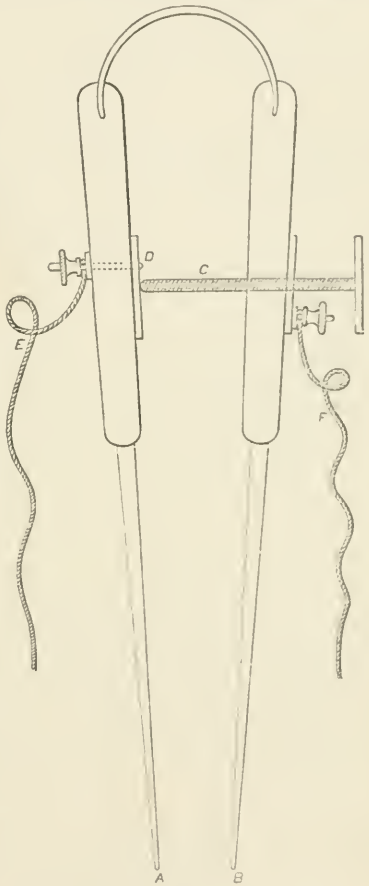
1. That an *abduction* of the vocal bands, a *dilatation* of the glottis, can be obtained WITHOUT ether.

2. That it is a physiological fact that the opening or closing of the glottis depends upon the *strength* of the stimulus.

3. That we have confirmed every statement made in my original paper.

My method of operating was somewhat changed from last year, as follows: The larynx was exposed and the recurrents were dissected out. The trachea was separated from the larynx by cutting through it just below the cricoid. This cartilage was then divided in the center and part of it cut away, thus giving a clear view of the movements of the cords. A Du Bois-Reymond induction coil, with a Daniell's cell, supplied the stimulus. It was very desirable to obtain a *tracing* of the movements of the cords, and this was done in the following way: The little instrument pictured here was placed between the posterior end of the cords so that the two ends, A and B, rested against the right and left cords close to the arytenoids. Now, the wires, E and F, were connected, one with the battery, the other with a pen which wrote on a revolving drum. A third wire, of course, connected the other pole of the battery with the pen, and completed the circuit. Now, in order to make the circuit, the point C had to touch the arm D of the instrument, and this could only happen when the ends A and B were brought together, and they could only be brought together by an *adduction* of the cords —a closure of the glottis. When the glottis was open, or when there was a further *abduction* on stimulation, the pen did not move from the base-line; if, however, there was an adduction, the current was

made and the pen rose. The tracings obtained in this way are given in Plates I and II for Experiments III and IV. It will be remarked that in these experiments *adduction* only is recorded. In order, therefore, to obtain a tracing of *abduction*, I changed the instrument given above, so that when the ends A and B rested against the cords, the point C touched D, and made the current, and the pen wrote above the base-line. If, now, any stimulus produced *abduction*, the ends A and B separated, the current was broken, and the pen fell from the base-line. The tracing of abduction thus obtained is shown in Plate III, Experiment IX.



The experiments given below and marked from one to fourteen were not made in that order, and are taken from a large number. In Experiments I, II, III, IV, V, VIII, IX, and XII, morphine *only* was used, in VI and VII ether, and in Experiments X, XI, XIII, and XIV *no drug*, the medulla having been destroyed.

As will be seen, the observations are arranged in three columns. The first gives the strength of the stimulus, the second the result, and the third the person or persons observing, with remarks. The different experiments were seen and the *results* of any given stimulation *observed* by Professor H. N. Martin, Professor W. H. Welch, Dr. W. H. Howell, the assistant professor of physiology; by Dr. Campbell, Fellow in Biology; Dr. W. P. Lombard, Dr. Beyer, Professor Donaldson, Dr. J. Solis-Cohen, of Philadelphia, Dr. John N. Mackenzie, Professor Sewall, of the University of Michigan, Dr. J. H. Hartman, Professor Reichert, Dr. Kemp, and many others.

The tracings shown in the plates are to be read thus: In Plate I, for instance, to take the lowest tracing marked 7th series, it means that the coil was started at 25, and at each stimulation up to 14 the result was called out by the person observing as consequent *abduction*, and hence the pen did not leave the base-line. At 14, however, the stimulus was sufficiently strong to produce *adduction*, as is shown by the rise of the pen and the marking on the drum, and adduction followed stimulation at 14, 13, 12, 11, and 10.

PLATE I.—Exp. III.

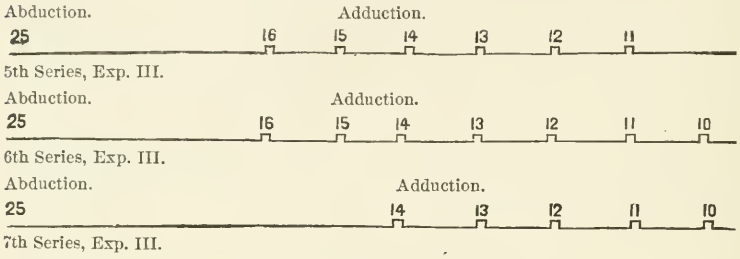
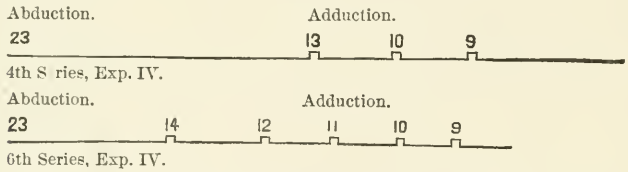
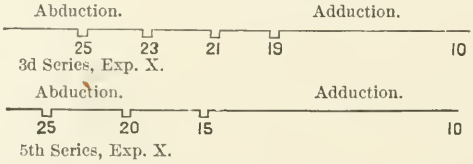


PLATE II.—Exp. IV.



In Plate III, on the other hand, the connection being made, the pen wrote above the base-line. Now, this connection could only be broken by an abduction of the vocal bands, and this took place, as can be seen from tracings (3d series, Exp. X), at 25, 23, 22, and 19, after which the various stimuli applied produced adduction; the connection was not broken and the pen did not leave its line.

PLATE III.—Exp. X.



Note.—Dr. Lombard kindly offered to photograph the abduction and adduction for me, but we were unable to carry it out. These tracings are a few taken for convenience from a large number.

EXPERIMENT I.

Coil at	Result.	Remarks.
1st Series.		
25	Abduction.	1½ gramme morphine; right recurrent stimulated; both cut.
23	"	
20	"	
15	"	
12	"	
10	Adduction.	
5	"	
2d Series.		
5	Adduction.	It was noticed that abduction was produced on slight stimulation; strong contact caused adduction.
10	"	
12	Abduction.	
3d Series.		
15	Abduction.	Professor Martin and Dr. Howell present.
14	"	
12	"	
10	Adduction.	
5	"	
4th Series.		
8	Abduction.	The stimulation was changed to a single shock, on the *break* only, and both nerves placed upon the electrode. *Abductor* fibers becoming exhausted, experiment stopped at 3.15.
5	Adduction.	
3	"	
0	"	

Series repeated over and over again without variation.

EXPERIMENT II.

Coil at	Result.	Remarks.
1st Series.		
10	Adduction.	Medium-sized dog; 1½ gramme of morphine; right recurrent cut.
7		
6		
5		
0		
2d Series.		
37 to 30	Abduction.	
29	Adduction.	
25	"	
20	"	
3d Series.		
40 to 34	Abduction.	At 35, adduction of anterior part of cord noticed, which continued.
30	Adduction.	
25	"	
20	"	
4th Series.		
34	Abduction.	Strength of battery (Daniell's cell) constantly changing.
30	"	
26 to 25	Adduction.	

Experiment III.

Coil at	Result.	Remarks.
1st Series.		
22 to 11	Abduction.	Large dog; two grammes of morphine; right recurrent cut and stimulated; the abduction was very marked; crico-thyreoid cut and thyreoid cartilage slit.
10	Adduction.	
8	"	
5	"	
2d Series.		
22 to 14	Abduction.	This series observed by Dr. Beyer and Dr. Campbell, who called out result.
13	Mixed.	
12	Adduction.	
10	"	
8	"	
3d Series.		
10	Adduction.	Observed by Dr. Beyer and Dr. Campbell.
11	"	
12	Mixed.	
14	Abduction.	
16	"	
18	"	
20	"	
4th Series.		
15 to 11	Abduction.	
10	Adduction.	
9	"	
8	"	
5th Series.		
25 to 17	Abduction.	Dog killed so as to stop all possible movement.
16 to 10	Adduction.	Instrument placed between vocal cords and connected with pen and tambour, and tracing obtained as in Plate III, 5th series.
6th Series.		
25 to 17	Abduction.	Observed by Dr. Fiske; tracing No. 6.
16 to 9	Adduction.	
7th Series.		
25 to 15	Abduction.	Observed by Dr. Fiske; tracing No. 7.
14 to 9	Adduction.	
8th Series.		
23 to 13	Abduction.	Observed by Professor Martin; tracing No. 8; nerve and muscles losing their irritability; experiment stopped.
12 to 7	Adduction.	

Experiment IV.

1st Series.		
18 to 11	Abduction.	Dog; 1½ gramme of morphine; crico-thyreoid cut; Dr. Lombard observed all series, Professor Martin several.
10	Adduction.	
8	"	
2d Series.		
18 to 14	Abduction.	Both recurrents *stimulated.*
13	Mixed.	
12	Adduction.	
10	"	
3d Series.		
24 to 12	Abduction.	Both recurrents stimulated.
11	Adduction.	

Coil at	Result.	Remarks.
4th Series.		
23 to 15	Abduction.	See tracing, Plate II; dog perfectly quiet.
13	Adduction.	
10	"	
5th Series.		
20 to 15	Abduction.	
14 to 10	Adduction.	
6th Series.		
25 to 15	Abduction.	See tracing, Plate II.
14	Adduction.	

EXPERIMENT V.

1st Series.		
30 to 10	Abduction.	Dog; 2 grammes of morphine; the first four series were observed, and the result called out by Professor W. H. Welch, Professor of Pathology.
9	Adduction.	
8	"	
5	"	
2d Series.		
25 to 12	Abduction.	Both recurrents cut; both stimulated.
11	Adduction.	
10	"	
9	"	
3d Series.		
5	Adduction.	Both stimulated.
9	"	
10	"	
11	"	
12 to 30	Abduction.	
4th Series.		
30 to 14	Abduction.	Both recurrents stimulated.
12	Adduction.	
10		
9		
5th Series.		
28 to 12	Abduction.	Dog killed. This and the following series observed by Professor Donaldson.
11	"	
10	Adduction.	
9		
5		
6th Series.		
	Same as last	

After a while the abductors lost their irritability, and adduction only resulted, which confirms my statement to this effect made last year.

EXPERIMENT VI.

Coil at	Result.	Remarks.
1st Series.		
30	Abduction.	Dog; 2½ grammes of morphine; then very deeply under ether; crico-thyreoid muscle and both recurrents cut; the battery was strong; *abduction* lasted much longer than without ether.
25	"	
22	"	
20	"	
16	Mixed.	
12	"	
10	Adduction.	

Coil at	Result.	Remarks.
2d Series.		
30	Abduction.	
26	"	
24	"	
22	"	
20	"	
18	"	
15	"	On slight contact a strong abduction.
10	Adduction.	
3d Series.		
30	Abduction.	Dr. Beyer observed the cords and called out the result of each stimulus.
28	"	
26	"	
24	"	
22	"	Less distinct.
20	"	
15	Adduction.	
4th Series.		
30	Abduction.	Dr. Beyer observed results.
28	"	
26	"	
24	"	
22	"	
20	"	On slight contact.
18	"	" " "
15	Adduction.	

Ether certainly has a peripheral effect. It prolongs the abduction, and makes it more apparent.

Experiment VII.

Coil at	Result.	Remarks.
1st Series.		
40 to 18	Abduction.	Dog under two grammes of morphine; both recurrents cut.
18	Mixed.	
17	Adduction.	
2d Series.		
35 to 18	Abduction.	Right recurrent stimulated.
17	Adduction.	
3d Series.		
35 to 18	Abduction.	Right recurrent.
17	Adduction.	

A large number of series were made without the slightest variation from the three given above. The nerves gradually became exhausted, and finally only very slight *abduction* could be produced, adduction generally resulting. The more irritable abductors had become worn out.

It suggested itself to me that I could have no better case in which

to show the *prolonging* effect of ether, for the abductors would not respond. Ether was therefore administered. I should state that this experiment and the next were observed by Dr. J. Solis-Cohen, who kindly came from Philadelphia, by Dr. John N. Mackenzie, and by Dr. Henry Sewall, Professor of Physiology in the University of Michigan.

When, therefore, the narcosis was pronounced by the three gentlemen present to be complete, the nerve was stimulated with the following result, and it will be seen that *abduction* distinct and prolonged was obtained.

Experiment VII—(*Continued*).

Coil at	Result.	Remarks.
1st Series.		
35 to 12	Abduction.	Right recurrent pronounced.
10	Adduction.	
8		
5		
2d Series.		
30 to 16	Abduction.	Both recurrents.
15	Adduction.	
10	"	
8	"	

Series repeated over and over again, with same result.

Experiment VIII.

Coil at	Result.	Remarks.
1st Series.		
35 to 18	Abduction very marked	Dog; under two grammes of morphine.
17	Adduction.	Cords very wide apart; both recurrents cut.
2d Series.		
30 to 18	Abduction very marked	Dr. Cohen, Dr. Mackenzie, Dr. Sewall, and Dr. Donaldson, Sr., present.
17	Adduction.	

Many series were done with the same results, the abductors finally failing to respond to stimulus.

Experiment IX.

Coil at	Result.	Remarks.
1st Series.		
36 to 18	Abduction very marked	Dog; two grammes of morphine; both recurrents cut.
14	Mixed.	
15	Adduction.	

Coil at	Result.	Remarks.
2d Series.		
30 to 18.....	Abduction.	
17.....	Adduction.	
3d Series.		
35 to 20.....	Abduction.	Both recurrents stimulated; Dr. Sewall present.
20.....	Mixed.	
18.....	"	
15.....	Adduction.	
4th Series.		
35 to 10.....	.....	Dog *profoundly* narcotized *with ether;* abduction greatly prolonged, and adduction finally done away with.
10.....		

Many series made without variation.

EXPERIMENT X.

Coil at	Result.	Remarks.
1st Series.		
25 to 19.....	Abduction. Mixed.	Dog; medulla destroyed; no drug;* operation quickly performed.
17.....	Adduction.	
14.....	"	
5th Series.		
25 to 15.....	Abduction.	
14.....	Adduction.	

Series repeated again and again without variation; *abductor* fibers became sooner exhausted.

EXPERIMENT XI.

Coil at	Result.	Remarks.
1st Series.		
28 to 18.....	Abduction.	*No drug* given; medulla destroyed; result of any given stimulus observed by Professor Martin and Dr. J. H. Hartman.
18.....	Adduction.	
17.....	"	
12.....	"	
10.....	"	

Series repeated again and again without variation.

It was remarked by all present that the abductor muscles died most rapidly.

EXPERIMENT XII.—This and the following experiments were made at the University of Pennsylvania in the presence of Dr. Reichert, Professor of Physiology, Dr. J. Solis-Cohen, Dr. Dalton Hays, of New York, Dr. J. H. Musser, Dr. Kemp, Assistant in Physiology, Dr. Hare, Dr.

* Professor Bowditch had written to Professor Martin to ask if he had *ever* seen an *abduction* produced without *any drug*.

Joseph Head, Dr. Theodore Martin, and Professor H. N. Martin, who kindly came from Baltimore to see the demonstration.

The dog was given two grammes of morphine. A very large number of series were made. *Abduction* distinct and prolonged was produced by *weak stimuli*, in some cases lasting *ten* and *twenty seconds*.

Adduction by strong stimuli always.

Experiment XIII.—In order to show that the results obtained in Experiment XII were in no way dependent upon any effect of the drug, the dog's medulla was destroyed.

Observations were made and continued until all the gentlemen expressed their entire satisfaction. In one instance in the experiment, abduction continued for as long as gentle stimulus was kept on, some *twenty-five* seconds.

Experiment XIV.—Performed with Professor Martin. No variation from former experiment. In one case, abduction lasted nearly two minutes, under a weak stimulus.

Proceeding to an analysis of these experiments, we find:

1. That an *abduction* of the vocal cords *can* be obtained *without ether*. This fact is abundantly proved, for in *every series* of Experments I, II, III, IV, V, VIII, IX, X, XI, XII, XIII, and XIV an abduction was obtained and seen by the observers quoted, and in *no case* was *any ether* whatsoever administered, and in Experiments X, XI, XIII, and XIV *no drug* at *all*, and abduction was produced for as long a time as desired.

2. That *abduction* followed *weaker*, *adduction stronger*, stimuli. This was an important point I made last year, and the present series of experiments confirm the statement, for, as will be seen, there was *no variation* in any case; gentle stimulation invariably produced *abduction*—strong, *adduction*.

3. That there is no variation whatever in the results.

Again, it was noticed that at a certain strength of stimulus slight contact produced a temporary abduction, strong contact, however, causing an adduction. In several cases where the nerve was stimulated *after death*, *abduction* gradually disappeared, giving place to adduction, which confirms the statement I made last year to that effect, *that the more irritable abductors die first*. This fact was brought out very strikingly in one experiment.

I was giving a demonstration before the Clinical Society of Baltimore, and, in order to have as little blood as possible, had tied both carotids. It was from an hour and a half to two hours before I proceeded to stimulate, and when I did so, *no abduction* at all could be *obtained*, a weak adduction alone appearing. I know of no better

way of demonstrating the greater irritability of the abductor muscles, which causes them to become so quickly exhausted.

This new and important fact that there is a difference in the irritability of the laryngeal muscles and nerve-fibers we may now, I think, consider as settled.

There are three important questions suggested by the above experiments, viz.:

1. The comparative irritability of muscles.
2. The ether effect.
3. The "proclivity" of the abductor muscles to disease.

On the Relative Irritability of Muscles.—The greater importance of certain muscles or groups of muscles in the body is well known, and it is not *a priori* unreasonable to suppose that such muscles should be more sensitive, more irritable, should respond to the gentlest stimulus, and so more rapidly perform their duty when called upon, than the less important and therefore less sensitive muscles. On the contrary, it is just what we might expect, as in the case of the more irritable *abductors* of the larynx. These are infinitely more important than the adductors.

The respiratory function of the larynx can not be suspended without danger to life, its phonatory function bears no such relation to the life of the individual, and the closure of the glottis is fortunately not entirely dependent upon those muscles which bring the vocal bands together. We find the muscles which open the glottis, therefore, far more irritable, responding always to the slightest stimulus.

Observations similar to my own have been made by Dr. Bowditch (*loc. cit.*) on the flexor and extensor muscles of the frog's leg, which are likened by him respectively to the abductor and adductor muscles of the larynx, and there certainly seems to be a remarkable similarity in their actions under weak and strong stimuli "without ether," says Dr. Bowditch; "flexion (and adduction of the toes) are only to be obtained with very feeble currents." And again "the important observation was also made that whenever flexion was obtained it could be converted into extension by *increasing* the *intensity of the current*," which agrees with my own results.

The great importance of the abductor muscles is sufficient to explain their great irritability, but it was not so easy to say why the flexor muscles should respond to a less stimulus than the extensors. We are unable at the present time to say whether the difference in irritability lies in the muscle or nerve-fibers.

The Ether Effect.—Dr. Bowditch speaks of my failure to obtain the ether effect. As I said in the beginning of this article, there was no mention of the ether effect in Hooper's paper nor in my own. I neither affirmed nor denied it. I said we did not *always* obtain abduction under ether for *all* strengths of stimuli. There is no doubt of the fact that ether greatly *prolongs* abduction in all cases, while in some it does away with adduction entirely, *abduction* only resulting from *all* strengths of stimuli.

The extent of its effect I have found to vary in different dogs. This, however, in passing and to correct a misapprehension. The subject is thoroughly discussed in Semon and Horsley's and in Bowditch's papers, and needs no further discussion here.

The so-called Proclivity of the Abductor Fibers to Disease.—I desire to add a few words on the much-vexed question upon which I have had reason to materially change my views since last year. In a paper, "Paralysis of the Lateral Adductor Muscle, with Unique Case," * I said:

"I desire here to define my own position in the matter, and to offer an explanation of the phenomena of this so-called abductor paralysis. In a paper read before the American Laryngological Association in 1886, I stated that my experiments gave no confirmation of Semon's assertion. On further consideration, I find this statement too broad. Whereas I was at first inclined to deny Semon's statement (on scientific grounds), I now go almost as far as he does—*i. e.*, I am fully convinced that *the abductor fibers are much more irritable and have much less power of resistance than the adductor fibers, and that they die sooner;* though I can not say that I have as yet any experimental (histological) proof that they degenerate more rapidly, after chemical, mechanical, or electrical stimulation, than the adductor fibers."

Both of these facts are abundantly proved by this present series of experiments, and I am now forced to agree with Semon that those cases where the vocal band is found fixed in phonatory position are true paralysis of the *abductor* muscle, and not spasm of the *adductor* muscles. Moreover, the constant implication of the abductor muscle may be explained on the ground of the greater irritability of the abductor muscle or nerve-fibers. *For in cases of unilateral or bilateral lesion of the cords from an aneurysm or tumor the constant pressure exerted by either upon the nerve acts as a mechanical stimulus to it, and the more irritable abductors are, therefore, the first to show the result of this constant stimulation in their loss of function.*

* "New York Medical Journal," February 12, 1887.

Another factor in the fixation of the vocal band in the phonatory position in the majority of cases, as shown by Dr. Gowers, may be the mechanical advantage at which the chief adductor acts, as compared with the chief abductor, which gives greater power to the former, since it passes nearly at right angles, while the abductor passes at a very acute angle, to their identical insertion into the muscular process at the outer angle at the base of the arytenoid cartilage. Any loss of power would, therefore, affect the abductor muscle most. It is but right, then, to confess that my experiments tend to confirm Semon's conclusion.

Finally, we hold that this series of experiments conclusively proves that it is a physiological fact that abduction can be obtained and is produced by feeble stimuli.

Note.—In the paper read by Hooper at the meeting of the association in May last, he devotes much space to the *peripheral* effect of *ether*, but again not a word does he say of the *rôle* that he, in his first paper, declared *consciousness* to play in the innervation of the larynx. In the discussion, however, he said: "When I used the word *consciousness* I meant the *'ether-effect'*"—*i. e.*, peripheral effect. This extraordinary statement needs no comment. It will be noticed, too, that Hooper says he could not obtain (satisfactorily) our results. This, I hold, is a purely negative argument, and proves nothing.

Discussion.

Dr. F. I. Knight said he would take only a few minutes in relating what he had seen of Dr. Hooper's experiments. The results of experiments upon animals must be applied with reserve to man, as the variability of these subsequent experiments of Dr. Donaldson's and Dr. Hooper's would prove. He had seen in Dr. Hooper's experiments the ether effects, which now were generally admitted. In one case there was failure to get the ether effect, which Dr. Hooper attributed to the age and size of the dog. He admitted that it was not quite constant, although he generally got it. At any rate, in that case the speaker had failed to see dilatation from ether narcosis. He had seen the experiment in which the large dose of morphine, forty-five grains, caused dilatation, and other cases in which smaller doses of morphine failed to produce any preliminary dilatation. He had seen cases in which chloral certainly did not produce it, but in one case it caused a mixed movement. In a number of cases he had failed to see preliminary dilatation. Although the operation was done expeditiously there was closure in all these cases. Certainly the fact, as seen by himself and others in Boston, remained, that dilatation appeared to result in Dr. Hooper's experiments only from etherization and profound narcosis from morphine. He did not doubt that Dr. Donaldson got preliminary dilatation as he had stated, but ex-

actly how the difference in results was to be accounted for, he did not know; perhaps by some difference in the method of experimentation.

Dr. Langmaid had seen most of the experiments seen by Dr. Knight, and could corroborate what he had said. He had seen Dr. Hooper try to get Dr. Donaldson's results, but he had not seen what he would like to see Dr. Donaldson himself do. He had seen one experiment, which had interested him very much. In that case a novel procedure was used. The dog was trephined, and a plug was inserted and pressure made upon the cortex. This was the only case in which he had seen what he supposed was described by Dr. Donaldson; there was marked dilatation. He could only state what he had seen, without making deductions, as he was not a physiologist. It seemed that there must be some difference in the manner of experimenting by Dr. Hooper and by Dr. Donaldson to account for the difference in results. The best way, probably, would be for the observers to make their experiments together.

Dr. Hartman said that at experiment No. 11, by Dr. Donaldson, he had been present by his kind invitation. Four dogs were used. In one, during the preliminary steps, the dog lost a great deal of blood, and it was evidently too late to get satisfactory results. But in the three other cases Dr. Donaldson got the results portrayed in his chart.

Dr. Mackenzie thought it strange that opinions on this subject should be so completely divergent. He could not pretend to criticise the results obtained by either of the experimenters, for he had not sufficiently examined the subject. All he could say was that he had observed one experiment at the Johns Hopkins University by Dr. Donaldson, the dog being under the influence of morphine, and that the movements described by Dr. Donaldson occurred in the most marked manner. Two grammes of morphine were given, he thought. When ether was administered, the movements of the cords were more pronounced.

Dr. M. Allen Starr, of New York, speaking by invitation, said he was unable to throw any light on the subject of the physiology of the larynx, but it might be of some interest to mention the fact that, when in Paris, he had witnessed some experiments upon hypnotized subjects by Professor Charcot, and in one instance, when he made slight percussion just below the larynx, there occurred at once adduction of the vocal cords, causing considerable interference with breathing. The case showed that slight mechanical stimulation of the recurrent laryngeal nerve in the human subject would produce adduction of the vocal cords.

Dr. Westbrook said it had occurred to him that perhaps all the factors concerned in this problem had not been taken into consideration by the experimenters. The pneumogastric nerve, as we all knew, was a very complex nerve. According to Professor Milne Marshall, it represented at least eleven nerves. In the human subject it was easy to count as many important branches—those going to the ear, the palate, the pharynx, the larynx, the trachea, the œsophagus, the stomach,

the liver, the lungs, and the intestines. In the motor branches going to the larynx there was this distinction, which, so far as he had observed, the readers of the papers had failed to bring out—namely, that the sphincters of the larynx which guarded the entrance to the lower respiratory tract during the swallowing of food were under peripheral control, whereas the abductors acted, not through reflexes from the larynx itself, but automatically through the influence of a center in the medulla oblongata. The one was under peripheral influence, the other under central influence. The peripheral mechanism was of very great importance, because it prevented us from being choked by the entrance of food into the air-passages. But the central apparatus was of still greater importance, because, as Dr. Hooper had once said, it stood as a sentinel to keep the glottis open to allow the air to pass into the lungs, and oxygen into the blood, throughout the entire life of the individual. As the speaker understood it, the partial closure of the glottis during expiration was not active, or was so only to a very slight extent; whereas the opening of the glottis during inspiration was an active process, and its great importance was shown by the fact that the vast majority of all the animal kingdom died with the glottis open.

Dr. Donaldson said that, after all this discussion, he thought he might be excused for saying that all the points he had made last year still stood, and the "inaccuracies" of his paper had not been proved. Dr. Hooper had said a deal about the ether effect in his present paper, which no one for a moment denied, but not one word about the rôle which, last year, he had maintained that consciousness played in laryngeal innervation. Again, in the April number of the "American Journal of the Medical Sciences," he had positively denied the speaker's statement that abduction could be obtained without ether. In his present paper he admitted that he did get abduction under morphine, and in one case (seen, too, by Dr. Langmaid) he had obtained abduction in a dog which had not been given any narcotic. Moreover, Dr. Knight had admitted that he, too, had seen dilatation without ether. Dr. Solis-Cohen had also informed the speaker that he had seen dilatation without ether in Dr. Hooper's laboratory. Again, in the paper just read, the latter had said that closure on stimulation was "not universally the case," which was a positive contradiction of his statement in Dr. Bowditch's late paper. The truth was, that the results of any given number of Dr. Hooper's experiments differed very widely. In the speaker's experiments, on the other hand, there had never been any variation from first to last, weak stimuli invariably producing abduction—strong, adduction. This fact, he maintained, had been established beyond doubt in his experiments of this year and of last year; the fact that Dr. Hooper could not obtain exactly the same results proved nothing; it was purely negative, and did not affect the physiological facts announced. He therefore thought that the statements made in what Dr. Hooper had been pleased to call his inaccurate paper might be considered as entirely confirmed.

The speaker, on being reminded by the secretary that important differences existed in his paper as read before the association last year and as it appeared in the volume of "Transactions," several changes having been made in the article itself, and several addenda supplied to it, said that after reading his paper last year, and before publishing it in the "Transactions," he had not revised it, but had eradicated the two sentences quoted from Dr. Hooper's paper.

Dr. Hooper thought that, when Dr. Donaldson came to read his (Dr. Hooper's) paper in print, some points might appear a little clearer to him. With regard to his own remarks concerning Dr. Donaldson's paper last year, to which Dr. Donaldson had taken such exception, and to which it seemed to him he had gone considerably out of his way to again refer, he was forced to remind him that, when he said his paper contained statements which were inaccurate, he referred to the manner in which he misrepresented and misquoted his (Dr. Hooper's) paper on "The Respiratory Function of the Human Larynx." His confusion was due to the speaker's failure to make his meaning clear to him. It was evident from his original paper in the "American Journal of the Medical Sciences" that he had misconceived the import and the significance of the speaker's experiments. He had not meant to imply that Dr. Donaldson's statement that feeble stimuli produced abduction of the vocal bands was inaccurate, although he had never been able to observe such an effect himself unless ether had been administered to the dog. He had stated last year that what he said in regard to the consciousness of the animal playing a part in the "ether effect" was merely a passing thought, yet the reader still dwelt upon it as if it were of some importance. He regretted that he had not used the word "narcosis" instead of "consciousness," as it would have expressed what he had in mind more clearly, and would have spared Dr. Donaldson, perhaps, some annoyance and unnecessary labor. When the "ether effect" was first observed, Professor Bowditch told him that he wished to make the observation the starting-point of a study of the action of sulphuric ether upon the peripheral nervous system. In their paper, published two years ago, they had merely recorded the fact, leaving its elaboration for future study. Now the statement of Dr. Donaldson that feeble stimuli applied to the recurrent nerves of unnarcotized dogs produced dilatation of the glottis was the point which needed confirmation. They (Dr. Hooper and Dr. Bowditch) had hoped to get this effect, and had tried their best to get it, in order to confirm Professor Bowditch's observations on the sciatic nerve of the frog (see "Amer. Jour. of the Med. Sci.," April, 1887), but they had failed to do so. They had recently devoted seven dogs to this study, according to the method they understood was Dr. Donaldson's, namely, observing the glottis from below through a window cut in the trachea. Three dogs were stunned and then pithed, two were pithed, one was unpithed and unnarcotized. In all of these animals their usual results were observed, namely, first a vibratory movement of the vocal bands and then a closure. The seventh dog, a very muscular

animal, was kept quiet by cerebral compression, according to Professor Dalton's method. This experiment was performed two days ago, and in this dog they had observed perfect dilatation with feeble stimuli. This method introduced a new element, but this was the only instance where they had been able to call forth a dilatation on unnarcotized dogs. They were inclined to regard it, therefore, as the very rare exception. Dr. Edward Martin, of Philadelphia, had sent the speaker tracings this morning which showed, as would be seen, that his results accorded with theirs as regarded the stimulation of the recurrent laryngeal nerves.

Paper.

THE PATHOLOGICAL NASAL REFLEX. AN HISTORICAL STUDY.

By JOHN NOLAND MACKENZIE, M. D.

"Nullum est jam dictum, quod non dictum sit prius."—Terence.
"Multa renascentur, quae jam cecidere."—Horace.

WITHIN the past few years the attention of the medical world has been more prominently called to a series of morbid phenomena, some directly referable to the nasal apparatus, others to regions of the body more or less remote from the nose, which seem to depend upon irritation or well-marked structural changes in the intra-nasal tissues, and which not infrequently disappear after removal of the source of irritation within the nasal cavities. These seemingly purely neurotic conditions have received the name of the *nasal reflex neuroses*, and embrace a host of sensory, motor, and vaso-motor phenomena, varying greatly in nature and anatomical sphere of operation. Various neuralgic conditions of the branches of the fifth and other nerves—cough, asthma, vertigo, nightmare, "hay fever," various spasmodic affections, general convulsions, diseased states of the nose, eye, ear, larynx, and bronchial tubes, symptoms referable to irritation of the gastro-intestinal, utero-ovarian, and genito-urinary tracts; even chorea, epilepsy, melancholia, retarded sexual development, and exophthalmic goître—have been mitigated or known to disappear with the cure of the nasal affection.

While in some of the recorded instances of these "reflex nasal neuroses" the enthusiasm and hasty judgment of the reporters have carried them too far, and while in many cases the direct connection between the nasal disease and the reflected phenomena is not sufficiently evident, still the fact is established beyond a reasonable doubt that a causal relationship does often exist between certain conditions

of the nasal passages and other portions of the respiratory tract, and a host of phenomena referable to other and remote organs of the body—a direct dependence or connection which justifies us in the belief of their reflex reciprocal relationship.

At the present day, when, by common consent, our knowledge of this class of affections is confined within the narrow limits of scarcely two decades, it may be interesting to glance for a moment beyond the writers of the present epoch to the literature of more distant times.

In the "Symposium" * of Plato, when the time came for Aristophanes to speak, he was seized with the hiccoughs, and, upon requesting Eryximachus to stop them and speak in his stead, was told that, if the hiccoughs were ever so violent, if the nose were tickled they would cease at once. This popular recognition of the sympathy between the nose and diaphragm is also distinctly affirmed in the sixth book of the aphorisms of Hippocrates: "If sneezing comes upon a man in a fit of the hiccoughs, it puts an end to the disorder." †

The consensus or sympathy between the nose and eye seems also to have attracted popular attention. Thus, Aristotle ‡ devotes two paragraphs of the thirty-third section of his "Problems" to the consideration of the question why rubbing the canthi of the eyes puts an end to sneezing. Avicenna,# to prevent sternutation, recommends rubbing the eyes, ears, extremities, and palate, whilst Rhazes, ‖ in his chapter on acute and chronic obstruction of the nose ("De alcasem"), mentions, among the symptoms of the latter, abrogation of the sense of smell with a co-existing diseased condition of the eyes. Rhazes also recommends the induction of sneezing "when the mouth is convulsed and drawn to one side," △ and mentions the fact that running at the nose, a cold in the head, and hoarseness may occur from the odor of violets, etc. ◊ The relation of certain affections of the head, and notably hemicrania, to congestive and even inflammatory disorders of the nasal apparatus, seems also to have been foreshadowed in the writings of the earlier physicians. Thus,

* Section 13. † Aph. 13. Compare also Celsus, lib. ii, cap. 8.

‡ Opera omnia gracco-latin., vol. iv, Problem xxxiii, 2 and 8, Parisiis, 1858. Ed. Didot.

Op. omnia, Venet., 1608, lib. iii, Fen. 5, tract 2, cap. 14.

‖ "Opera medica," Basiliæ (date uncertain, 1544 or 1450, Lib. S. G. O.). Divisionum, lib. i, cap. 43.

△ *Op. cit.*, "Ad mansor. de re med.," lib. ix.

◊ *Ibid.*, cap. xiii.

in the "Medical Compositions" of Scribonius Largus* is found the following direction for the cure of certain forms of headache: "*Oportet vero permanente capitis dolore, materiam quoque detrahere ex eo per nares vel os.*" Largus (Composition X) advises sternutation as a remedy for headache.

The dependence of catarrh, coryza, asthma, syncope, convulsions, and a host of other phenomena upon the presence or odor of roses, lilies, peonies, and other flowers, has been recognized for centuries. For, although Pliny † informs us that the seed of the rose inhaled into the nostril has the effect of clearing the brain, there are many cases to be found among the older writers in which the odor of various substances, such as the rose, was known to result in epilepsy, syncope, and even death, ‡ and there is a tradition that the Roman ladies conceived an especial aversion to the odor of the queen of flowers.

The diagnostic acumen of Galen # led him to the observation that in certain persons the presence of various foods is sufficient to excite a coryza, and scattered here and there through the literature of succeeding centuries isolated cases are found in which similar peculiarities in regard to flowers and other objects are recorded. ‖

* Scribonius Largus, "De compositionibus medicamentorum liber unus," Parisiis, 1529. Ed. Vuechel, Comp. vi.

The ancients included under the generic term headache the affections known as cephalalgia, cephalea, and hemicrania or heterocrania, the latter term being employed by Aretæus ("De caus. et sig. morb. chron.," liber i, cap. 2). Aretæus says the sense of smell is vitiated in heterocrania.

† "Nat. hist.," lib. xxi, cap. 73. The same writer (lib. vii, cap. 7) also observes that the smell of a lamp which has been extinguished will often cause abortion, and that the latter ensues should the female happen to sneeze just after the sexual congress.

‡ While there is a remote possibility that this observation of the ancients, which finds its reflection in the poetic imagery of Pope, may have some slight foundation in fact, it is extremely doubtful whether, in the cases referred to, death was due to the simple inhalation of the odorous particles of the flower, for in some of the recorded instances the victims were confined to closed chambers, and were possibly poisoned by the displacement of the oxygen of their bedrooms by the noxious exhalations from the plants. It should also be remembered that our less civilized and punctilious brother-man of a few centuries back did not hesitate to dispose of an enemy through the covert instrumentality of poisoned flowers and other equally insidious devices, by means of which the deadly agent was introduced into the system through the respiratory mucous membrane.

"Fragment. ex aphor. Rabi Moyses." Good, "Study of Medicine," Boston ed., 1823, vol. i, p. 311.

‖ In certain individuals, or even families, this peculiar antipathy or suscepti-

In the light of our present knowledge of the affection known as "hay fever," it is scarcely conceivable that it made its first appearance at the beginning of the present century. As Dick, and afterward Matthew Baillie, thought that in describing their first cases of laryngitis they had discovered a new disease, so Bostock, in portraying the symptoms of "*catarrhus æstivus*," was led into a similar error. For no one can arise from the perusal of the older writers on asthma without the conviction, or at least the suspicion, that this disease has descended to us through the centuries as a species of the "convulsive asthma" and "periodic coryza" of the more ancient nosologists, who in their state of medical science did not resort to the nosological refinements which proceed from the more advanced pathological research of the present day and century.

I have shown elsewhere * that the so-called "idiosyncrasy," by virtue of which the presence or odor of certain flowering plants is sufficient to create disturbances referable to the nasal chambers and other portions of the respiratory apparatus, was familiar at a remote period of medical history. In the days when medical writings were published in Latin, the necessity of recording one's observations in a foreign tongue led to a terseness of style and incompleteness of description which often surrounded with uncertainty the exact nature of the cases reported; but, whether the records referred to were examples of true vaso-motor coryza or not, they may be placed in the same category of affections, and the predisposing influences be considered identical with those provocative of the disease called in the present century "rose-cold."

To Voltolini (1871) is universally and erroneously attributed the credit of pointing out the interesting relationship between asthma and nasal disease. I pointed out at the last meeting of this association,† however, from the writings of Aurelian, Zecchius (1650), Schneider, Floyer (1726), Bree (1811), Trousseau, Follin and Duplay, and Ferber (1869), that the association of these two conditions was known long before the time of Voltolini. Among these writers, Ferber, referring to the frequent association of sneezing, migraine, hay fever, and bronchial asthma, advanced the theory that these phenomena were the expression of a neurosis of the trigeminus nerve—

bility to particular flowers or foods takes the form of nose-bleed, in others violent purging occurs, or even epileptoid convulsions.

* "Trans. of the Med.-chir. Fac.," 1885. "Am. Journal of the Med. Sciences," January, 1886.

† "N. Y. Medical Journal," February 26, 1887; also "Trans.," 1886.

a view which has recently been resurrected in a modified form by Schadewaldt.

The association of epileptoid seizures, or even true epilepsy, with some irritation in or about the nasal passages, or peculiar susceptibility on the part of certain individuals to be thrown into epileptic convulsions through the application of some forms of matter to the nasal mucous membrane, seems to have been familiar from the earliest times. We learn, for example, from Aretæus ("De causis acut morborum," lib. i, cap. 1, ed. Boerhaave, Ludg. Bat., 1735) that the gagate stone (a species of hard coal or jet) was utilized by the ancients as a test for epilepsy, for when applied to the nostrils the sufferer was thrown into epileptoid convulsions. Pliny (lib. xxxvi, cap. 34) also alludes to this test, and to the power of the smell arising from burning goat's horns or deer's antlers in accomplishing the same result (lib. xxviii, cap. 63). According to this historian, the secundines of a she-ass, placed under the nostrils of the patient when the fit is approaching, will effectually dispel it. It is also a curious historical fact that Avicenna ("Op. omn.," Venet., 1608, lib. iii, Fen. i, tract v, cap. 8, p. 499) mentions (*l. c.*, Fen. 5, tract ii, cap. 15, p. 585) "rosa cum suis pilis" among the milder measures resorted to to provoke sternutation, and regarded sneezing itself as a mild form of epilepsy (*epilepsia levis*), and that a similar opinion was entertained long afterward by the learned Fernelius ("Medicina," Lutetiæ Parisiorum, 1554, "De epilepsia").

Fernelius treated also of the association of hemicrania and catarrh, which, in the quaint* language of his translator, was supposed to be due to "a vapor which, arising from choller flowing out of the liver into the stomach, does smite and twitch the membranes of the brain, yielding matter peradventure to the distillation." Elsewhere† he reports the case of a boy eleven months old, who was sick of a catarrh, who "sucked much and pissed little," and who was cured by anointing the region of the kidneys with oil of scorpions, which caused a flow of urine and the cure of his catarrh. Fernelius observes that in the eighth book of Mercatus on "Diseases of Children" it is stated that catarrhs sometimes happen in children from weakness or fault of the kidney. Farther on (p. 65) he gives a case in which suppression of urine was supposed to proceed from a catarrh in the head; "the flowing humor had invaded the body of the bladder

* "Select Medicinal Counsels of Johannes Fernelius," bound with the Works of Riverius, London, 1668. Author's library. Counsel III, p. 325.

† Page 35.

and bred some tumors therein, by which the sphincter of the bladder was compressed and the passage of the said bladder made straight."

In the seventeenth century Salmuth * called attention to the fact that paroxysms of epilepsy are often resolved by the eruption of blood from the nose, and related a case of "periodic paralytic tremor" in a woman of fifty, dependent probably on a subacute form of catarrh.

In 1656 Bausner † wrote an essay devoted to the consideration of the sympathies between the different parts of the body, in which he alludes briefly to the relation between affections of the stomach and coryza, and to the effect of obstruction of the nostrils on the voice and respiration.

In 1682 Wedel ‡ treated of the association of vertigo and sneezing, and in the same year Van Helmont,# in several chapters of his work, discussed the effects of sweet odors in the production, not only of epilepsy, but headache, nausea, vomiting, cough, hiccough, vertigo, apoplexy, dysentery, and other affections. He also alludes to the fact that, while sweet odors give rise to asthma in some, in others they produce, instead of asthma, hemicrania, palpitation, and syncope. This writer regards such disturbances as of frequent occurrence, and is looked upon by some as the first to recognize the affection known as "hay asthma." ‖ He explains the mechanism of such attacks by the operation of the "archæus," on the fantastic theory with which his name is inseparably associated in medical history.

Two cases of probable "rose-cold" were related toward the close of the seventeenth century by Binningerus △ and his contemporary

* "Observationum medicarum centuriæ tres posthumæ," Brunsvigiæ, 1648, cent. ii; obs. 13, p. 65; and obs. 60, p. 87.

† Bartholomy Bausner. "De consensu partium corporis humani," lib. ii, cap. 2. Amstelodami, 1656.

‡ "Dissertat. aeger vertigine laborans," Ienæ, 1682. "Diss. de vertigine," Ienæ, 1707 and 1741.

Johan Baptist Van Helmont. "Op. omnia," Francofurti, 1682. "Imago fermenti impregnat massam semine," p. 110, § 10; p. 344, § 10; and p. 348, § 41. This author also refers to the case of a monk, employed in pulling down buildings, who grew asthmatic from the constant inhalation of dust.

‖ Bergeron. Thèse d'agrégation, 1872, referred to by Louis Villemsens. Thèse de Paris, No. 494, 1872. "Étude sur le cat. spasmodique d'été," etc.

△ Johan Nicolai Binningerus. "Observationes medicinal. cent. quinque," etc. Montbelgardi, 1673. Obs. 86, p. 227. I am indebted for this reference to the work of Dr. Morell Mackenzie—"Hay Fever," etc., London, 1885. Third edition, p. 48.

Ledelius,* and Pechlinus† reported the case of a pharmacist who was thrown into violent paroxysms from the odor of violets in his urine, and was only relieved upon the return of the natural odor to the excretion. The same writer relates another case, in which a woman, having taken saffron for some menstrual trouble, was seized with coryza, headache, sneezing, and other annoying symptoms.‡

In the early part of the last century Baglivi# called attention to the fact that irritation of the nostrils by snuff (of tobacco) might provoke a desire to go to stool. This same observer also called attention to the association of asthma and urticaria.‖

A few years after the publication of Baglivi's work, Gumprecht△ discussed the sympathetic troubles connected with the inhalation of vapors into the nostrils, and explained them on the theory that the vapor taken into the nose affected preternaturally the branches of the fifth pair of nerves and was reflected to the fauces, stomach, heart, and lungs through the medium of the intercostal and eighth pair (Willis).

This nerve theory, which was the outcome of the neuro-pathology of Willis◊ and Vieussens,‡ was subsequently insisted upon by Henricus Josephus Rega in an elaborate general discussion of the sympathies between the different organs of the body.‡

Rega mentions the sympathy of the uterus and fauces, and that between the fauces and parts lower down.

During the first part of the last century there appeared a ponderous work by Johan Jacob Wepfer‡ consisting of a collection of cases

* "Miscellan. nat. cur.," Dec. ii, anno i, Obs. 140. This case is not infrequently referred to by the writers of the last century, and also by Phœbus ("Der typische Frühsommer Katarrh," etc., Giessen, 1862) and Morell Mackenzie (*op. cit.*).

† Joh. Nicol. Pechlinus. "Observationum physico-medicorum libri tres," etc. Hamburgi, 1691, lib. ii, obs. 50, p. 332.

‡ *Op. cit.*, lib. i, obs. xli, pp. 94–96.

"Opera omn. med. practic.," Lugd., 1714, spec. lib. i, cap. x, p. 342 *et seq.*

‖ *Op. cit.*, p. 104.

△ Georg Gottlieb Gumprecht, "Diss. de consensu partium præcipuo pathologiæ et praxeos medicæ fundamento." Halæ-Magdeburgicæ, 1717.

◊ "Cerebri anatome cui accessit nervorum descriptio et usus." Amstelodami, 1666, inter al. capp. 21, 25, 26, and 27.

‡ "Neurographia universalis." Lugduni, 1685, lib. iii, caput v, de nervis intercostalibus, eorumque muniis.

‡ "De sympathia seu consen. part. corp. humani, ac potissimum ventriculi, in statu morboso, diss. medica." Harlemi, 1721.

‡ "Observationes medico-practicæ de affectibus capitis internis et externis." Scaphusii, 1728.

illustrative of the external and internal diseases of the head, in which the relationship of hemicrania and other pathological phenomena to nasal inflammation and obstruction was distinctly and emphatically announced. Nothing seems to have escaped the far-reaching experience and accurate observation of this writer, to whose powers of description and diagnostic acumen it would be difficult to do justice within the limits of this review. So instructive is every case and page that it would be hard to make a selection, and I shall therefore only refer briefly to the following:

Obs. xxxiv, pp. 75, 76. Association of cephalalgia with sternutation, screatus, cough, and coryza, supposed to be due to irritation of the dura mater.

Obs. xxxvi, pp. 80–82. Paroxysms of violent headache, vertigo, pain from the nucha to the head, debility of memory and vision, tremor, cough, pain in the eye and about the nose, due to obstruction of the nostril from abuse of tobacco, which caused retention of mucus within the nostril, and awakened the above-mentioned symptoms from the sympathy of the latter with the meninges about the torcular Herophili. In this case the mucus retained in *the deeper portions of the nostrils* (*profunde intra cavernas narium retentus et inspissatus ab aere ex pulmonis expirato præservido*) was supposed to draw the mininges into consent.

Obs. xxxviii, pp. 84, 85. Association of pains in head, tinnitus, pains in humerus, various nervous symptoms and vomiting, with inflammation of the fauces. A very interesting case.

Obs. xl, p. 94. Says he has frequently observed hemicrania due to obstruction of the nares.

Obs. xlii, pp. 100–102. Case in which intense paroxysms of periodic cephalalgia and hemicrania were preceded by stupor of the head with gravedo. The patient suffered from obstructed nostrils, with tendency to somnolence and delirium. When the acme of the paroxysm was reached, vomiting of a tenacious mucus with bile occurred, with relief to the symptoms.

Obs. xliii. Case of a man suffering from obstructed nares, who was troubled for seven years with daily pain in the head in the morning when he arose from his couch, to which were soon added heaviness of vision, vertigo, tinnitus aurium, debility of the joints, with tremulous movements of the same. These symptoms were relieved by drawing the mucus from the head and nose into the fauces. The mucus was removed with difficulty owing to the narrowness of the nostrils from obstruction. He explains the case on the theory of sympathy and laxity of *the pores in the spongy bones.* Wepfer believes the trouble to have been an invasion of the spongy (turbinated) bones, and observes that in such cases the indication is to remove the inspissated mucus from the nares. A most interesting case.

Obs. xliv. Hemicrania from an acrid serous discharge.

Obs. xlvi, pp. 109–125. Headache, cough without expectoration, asthma, palpitation of the heart, and signs of phthisis. Tubercles in the lung were suspected "because crude tubercles were seen in the fauces at the root of the tongue such as are described by Galen" (probably follicular faucitis).

Obs. xlvii. An instructive case of hemicrania and coryza with "constipation" of the nose.

Obs. lii, p. 140. Hemicrania with swelling of the parotid gland, tinnitus, and unilateral discharge from the ear and nostril.

Obs. liv. Association of hemicrania with loss of olfactory sense, dimness of vision, muscæ volitantes, etc., with an acrid discharge from the nose which stained the handkerchief yellow.

Obs. lvii. Hemicrania, tinnitus aurium, vertigo associated with uterine trouble, sneezing, and a nasal discharge.

Obs. lxxii, pp. 241–244. Vertigo associated with a nasal discharge, dimness of vision, nebulæ before the eyes, tinnitus aurium, wax in the ear, etc.

Obs. lxxv. Vertigo supposed to come from hydrocephalus; says in such an event, if the nostrils are obstructed, give errhines.

Obs. lxxvi, p. 256 *et seq.* Remarkable case of vertigo associated with asthma at night and tendency to nasal hæmorrhage. The paroxysms were mitigated by forcible screatus or vomiting. Thinks it came from stomachic trouble originally.

Obs. lxxvii. A patient who used tobacco as a stenutatory to excess became subject to nasal hæmorrhage, dyspnœa, occasional deafness with tinnitus aurium, and vertigo with convulsions. The brain was perfectly clear during the paroxysms. Wepfer observes that such affections, if neglected, are apt to degenerate into epilepsy.

Obs. lxxviii. Vertigo, convulsive movements, nightly terrors, etc., in connection with mucus in the fauces, etc.

Obs. lxxix. Hemicrania, vertigo, tinnitus aurium, and tremor of the joints in a person whose nares were sometimes dry, while at other times they were filled with a limpid mucus which flowed in quantity from the nose, causing redness and excoriation of the latter. In the same observation (p. 296) he speaks of the association of mucous vomiting, fluor albus, recurring coryza, lacrymation, etc., from the suppression of a diurnal coryza.

Obs. lxxx. A most instructive case of a woman, sterile throughout her entire life, who, an habitual sufferer from coryza, was seized at the autumnal equinox with vertigo, tinnitus, troubles about the head (debility, sweating), with a peculiar vibration about the left eye, with obscure vision, and with many-colored nebulæ before the eyes.

Obs. cv, p. 469. Catarrh, gout, coryza, occasional attacks of vertigo, etc.

Obs. cx, pp. 486–488. A man, subject to catarrhal affections of the tonsils and throat, suffered from paroxysmal convulsive movements of the

throat and neck, especially of the right side, with a sense of compression and constriction of the larynx.

Obs. cxci. Nasal polypus, with hemicrania from a carious tooth.

Obs. cxcv. *Coryza prope continua.* A patient suffered with chronic coryza, with itching of the nose. He was finally seized with vertigo, weakness of vision, trouble with the memory, a sense of heaviness about the forehead, temples, and orbit, and even in the eyes. To these symptoms were added oppression about the chest, with dyspnœa and headache, especially when going up stairs and in mountain ascents.

Obs. cxcvi, p. 917. *Narium obstructio.* A case of extraordinary interest. A man, aged seventy-six, of medium height, tolerably fleshy and of good color, suffered with prolonged attacks of coughing, which could be increased by an effort of the imagination alone. He was especially subject to the cough in winter, and if, perchance, he got his feet wet, he was immediately seized with a paroxysm, so that he was obliged to be confined to the house during the whole of the winter season. His chief and apparently only trouble was an occlusion of the nares which prevented sleep, or if, by chance, he fell asleep, he was immediately awakened. The nostrils, when freed from mucus, would become patulous, and soon again become occluded. On examination, the right naris was found occluded by a sort of "sarcoma" of the ala. A similar "sarcoma" occupied the internal surface of the left ala. Neither was so attached as to allow of operation by the knife or cautery (*ferro vel igne*). Whenever he inhaled sharp medicines into the nares, he experienced pain about the cribriform bone and in the occiput. When he lay on the left side, he suffered from pain under the left breast, and was seized with a dreadful sense of oppression, which threatened leipothymia. In other respects he seemed to be well, he lived temperately, his heart never palpitated, he breathed easily in ascending stairs, etc.; he did not suffer from vertigo, headache, etc.

Wepfer, in commenting on this case (p. 918), observes that the chief interest centers in the peculiar narrowness of the nostrils and the nocturnal trouble, and goes into a differential diagnosis. After excluding heart and other troubles, the absence of any vestige of polypus or common sarcoma in the nose and fauces, he concludes that the trouble was due *to a turgescence of the myriad vessels of the spongy bodies* (*corpora spongiosa*), which prevented the air from passing to the os cribriforme, fauces, and palate. The obstruction caused, he thought, retention of mucus in the nostril, which became inspissated by the air coming from the lungs, and which, furthermore, tended to increase the narrowness of the passage.

About the middle of the last century Daniel Langhans* published

* "Diss. de consensu part. corp. humani," Gott., 1749; also in Haller's "Collect. dissertat. pract.," vol. vi, No. 220.

an elaborate dissertation which deserves special mention, in which he adverts to the *rôle* of the superior cervical ganglion in the evolution of sympathetic (reflex) acts—such as asthma, cough, etc., from irritation of the stomach, uterus, and other organs of the body.

In 1760, Morgagni * explained more fully the sympathy between the nostrils and the diaphragm and the abdominal viscera, calling attention at the same time to the communication between the fifth pair of nerves and the intercostals (Willis). In illustrating his theory, he called attention to the case of a nobleman in whom epileptoid convulsions were preceded by a fœtid smell only perceptible to himself; also to that of an old drunkard, who sneezed for two or three years for a quarter of an hour each day, and finally died suddenly. On post-mortem, there was discovered hypertrophy of the heart.† In another place he tells of a man of forty, an habitual drinker, who suffered for some time from dyspnœa (asthma), with frequent and severe fits of sneezing. One day, in a paroxysm of sneezing, he felt a sudden contraction of the heart, sneezed once more, and died.‡

In 1761, H. Boerhaave,# speaking of sneezing in connection with intestinal parasites, makes the assertion that if a healthy man fasts longer than is his wont, he feels a disagreeable sensation about the præcordia, *sneezes*, and then vomits. Following Avicenna, he compares the sneezer to the epileptic. In the same year Thomas Bartholini‖ tells us that, after phlebotomy, when the wound is closed and the cicatrix is yet tender, some are taken with sneezing. In commenting on this remarkable association, he states that he has observed sneezing during coitus. Bartholini also reports△ an interesting case of a gentleman who suffered from chronic coryza, which rendered sleep and respiration difficult. The cause of the dyspnœa was an oblong, rounded, smooth, white membranous vesicle filled with serum, which at times hung out of the nostril, which could be returned by pressure with the finger, and which interfered with smell and respiration. He goes on to say that the patient experienced relief from the use of sternutatories taken at the advice of friends, and adds that the remedy in such cases is to lie on the side opposite to that of the obstructed naris. In commenting on

* "De sedibus et causis morborum," epist. xiv, 28.

† *Op. cit.*, xxvii, 28. ‡ xiv, 27.

"Prælectiones academicæ de morbis nervorum," etc., Lugd. Bat., 1761, tom. ii, p. 835.

‖ "Historiarum anatomic. et medic. rariorum.," cent. v et vi, Ed. Hafniæ, 1761, v, p. 184.

△ Cent. vi, pp. 260–262.

the diagnosis of the case, he says that Erastus observed that the mamillary processes (olfactory lobes) were protruded into the nose in epilepsy, and concludes that these vesicles are found in the place of the caruncles in the spongy bones (doubtless the corpora cavernosa).

In 1765 appeared a thoughtful treatise on nervous diseases by Robert Whyte,* of Edinburgh, in which he calls attention to the fact that "several delicate women, who could easily bear the smell of tobacco, have been thrown into fits by musk, ambergris, or a pale rose, which to most people are either grateful, or at least not disagreeable" (p. 125). He also mentions similar antipathies in regard to cinnamon and other substances.

Whyte alluded to the sympathies between the larynx, pharynx, and ear, and advanced the doctrine that the impressions made upon the terminal filaments of the nerve (as, for example, in ear cough) must be first referred as a particular feeling to the sensorium commune before being reflected to other parts of the body. He thus made an important step beyond the older doctrine, which ascribed sympathetic affections to the communications between the nerves themselves.

One year later, Daniel Wilhelm Triller, in his curious work,† dwelt upon the so-called idiosyncrasy of olfaction in regard to roses and violets, and related two cases—one of a noble bride, who, sitting surrounded by roses, and weaving them into garlands, became suddenly prostrated, and, falling into the arms of her attendant, who rushed to her assistance, was soon lifeless; the other (described at great length), the history of a case in which death occurred from the odor of violets in a closed chamber.

In the same year the association of stomachic irritation with coryza was discussed at length by Schroeder and May,‡ and Robert Boyle,# in the edition of his work on exhalations, etc., published in 1776, treated briefly of the accidents arising from the odor or presence of roses, and toward the close of the last century a num-

* "Observations on the Nature, Causes, and Cure of those Diseases which have been commonly called Nervous, Hypochondriac, and Hysteric." Second ed., Edinb., 1765, p. 125.

† "Opuscula medica ac medico-philologica." Francofurti et Lipsiæ, 1766, vol. i, Diss. ix, p. 237 *et seq.*

‡ "Diss. de amplitu generis febris billiosæ." Gotting., 1766, § 12.

"Exercitationes de atmosphæris corporum consistentium; deque mira subtilitate, determinata natura ac insigni vi effluviorum." Lugd. Bat., 1776, cap. vi, p. 213 *et seq.*

ber of dissertations appeared on idiosyncrasy in general, in which the antipathy of certain persons to roses is mentioned, and of which the pamphlet of Rahn * is the most complete and original.

Rahn collected a number of cases from the "Acts and Ephemerides of Natural Curiosities," and from other sources, and founded upon them an interesting dissertation, in which, among other things, he mentions (quoting from the "Journal de médecine," tome xxv, p. 442) hemicrania from disease of the nose in the following sentence: "*Aliquando periodicam hemicraniam coryzæ antecedunt et ægros fallunt, ut hanc pro illius causa habeant cum tamen spastica utriusque sit origo.*" He explains the sympathies of the nose (on the nerve theory of Willis and Vieussens) by the intimate connection between the nasal nerves and the intercostals (of Willis).

A number of special treatises followed the *brochure* of Rahn, which added little or nothing, however, to what was already known upon the subject, and consisted for the most part of the transcription of the views and cases of those which preceded them. The most elaborate of these are the dissertations of Michell † and Veegens. ‡ To these writers I am indebted for reference to a very interesting case of catarrh with convulsions and hemicrania from disease of the uterus and ovaries observed by Bauhin, # and to one reported by Zimmerman, in which acute pain in the nose followed excessive venery (tribadismus). Veegens devoted considerable space to the sympathy of the stomach and nose, borrowing a great deal from Rahn without acknowledgment.

Ias ‖ (1784), and afterward Schmidt △ (1795), discussed at great length the same subject, without adding anything novel or of special interest. The latter, however, refers to the well-known sympathy between the nose and eyes in the case of sneezing from sudden exposure to light, and adds that "many diseases of the eyes may be cured by errhines."

* "Exercitationum physicarum de causis physicis miræ illius, tum in homine, tum inter homines, tum denique inter cetera naturæ corpora sympathiæ secunda." Turici, 1788. Rahn quotes from Baumer the case of a youth taken with periodical emprosthotonus from the odor of musk.

† In Schlegel's "Sylloge selectiorum opusc. de mirabile sympathiæ quæ partes inter diversas corporis humani intercedit." Lipsiæ, 1787.

‡ "Diss. inaug. med. de sympath. inter ventriculum et caput, præcipæ in statu præternaturali." Lugduni, 1784.

This case is also in Lieutaud's "Histor. an. med.," Obs. 1507, vol. i.

‖ "Diss. de mirabili quæ pectus inter et ventriculum intercedit sympath." Lugd. Bat., 1784.

△ "Diss. inaug. de consensu part. corporis humani inter se." Halæ, 1795.

In 1785 Tissot* called attention to the fact that very violent paroxysms of migraine are sometimes terminated by slight hæmorrhage from the nose, and related the case of a man of his acquaintance, an habitual sufferer from migraine on the same side in which he had a polypus in the nose, to which it owed its origin.† To Tissot I am indebted for reference to two interesting cases of migraine. The first is taken from the "Sepulchretum" of Mangetus.‡ A woman complained of a migraine of the right side. Bleeding, cephalic pills, etc., were of no avail. She asserted that she felt a vertigo with each movement of the head, and that it felt like a bladder filled with water. Vesicatories were placed behind the ears, and tents dipped in a volatile essence were introduced into the nostrils, which latter produced a prodigious discharge of serum and the cure of the affection. The second is taken from Sauvages: A soldier received a wound of the head at Strassburg, and suffered from terrible migraine for three years. The disease resisted all remedies, but was finally cured by an abundant discharge of pus from the nose, lasting twenty-four hours. Tissot includes this case under that variety which depends on disease of the accessory sinuses.#

In 1790 Testa‖ related the case of a woman who had never menstruated, and who was taken every third day with a paroxysm of sneezing so that she could neither eat, drink, nor sleep.

In 1797 we find Darwin△ reporting a case of nasal polypi due to the irritation of worms in the intestines, and in 1801 Gruner◊ alludes to sneezing in hysterical women as a prodrome of the attack, and in retention of the after-birth; to the same reflex in the dissipation of cough, hiccough, and allied evils; to its occurrence in those suffering from hernia, in pregnancy, and skin eruptions. This writer says‡ the nose becomes warm and red in the hysterical, in women at the menstrual period, and in the victims of onanism.

* "Œuvres." Lausanne, 1788, vol. ix. "Traité des nerfs et de leurs maladies." A Genève, 1785, chap. xxii. "De la migraine," p. 105.

† *Op. cit.*, p. 169. ‡ Tom. i, p. 16.

The dependence of migraine on the presence of parasites in the nostrils has been familiar for centuries. See Ploucquet, "Literatura medica digesta," tom. iv, p. 314, and note 1, p. 216. Ludwig Frank, "Med.-chir. Ztg.," Salzburg, iv Bd., 1815.

‖ "Bemerkungen über die periodische Veränderungen, etc.," Leipsic, 1790, p. 225.

△ "Zoonomia," part ii, vol. 2, p. 73, Phila. ed., 1818.

◊ Christian Gottfried Gruner, "Physiologische u. pathologische Zeichenlehre," etc. Jena, 1801, p. 122.

‡ *Op. cit.*, p. 377.

In 1802 Heberden* observes that "a large suppuration of an inflamed sore throat has been attended with a considerable quantity of pus at the bottom of the vessel which held the urine, for three or four days. As soon as the abscess broke and discharged itself, this purulent appearance in the urine ceased." Heberden, as is well known, was supposed to have approached very nearly the discovery of the disease known as "hay fever." †

In 1804, Deschamps ‡ maintained the view that hemicrania was a disease of the frontal sinus, and related some experimental observations illustrative of the great sensibility of this cavity; and in the same year Portal ‖ observed that he had seen pains, vertigo, and even epileptic affections, in connection with disease of the nasal membrane, and referred to a case accidentally cured by the fumes of cinnabar, given with other intention.

In 1818, Josef Frank,# in his chapter on headache, says: "*Nares plerumque siccæ, aeri imperviæ, nonnunquam serum acre largientes. Sapor interdum deletus, sæpe deprivatus, amarus scilicet, acidus, quandoque metallicus. In nonnullis, screatio frequens, stridor dentium, tumor parotidis. Loquela nonnunquam interrupta*, etc." Frank also called attention to what he termed rheumatic or catarrhal vertigo.△

This brings the history of the pathological nasal reflex down to the year 1819, when the affection known as "hay fever" is supposed to have been discovered by Bostock. That this latter disease was probably recognized centuries ago, I have endeavored to show in a former publication, ◊ in which is given what may be considered its earlier literature. Those who desire to investigate also the ancient history of the nasal "idiosyncrasies" may consult this article and also the list of essays and cases embodied therein, which have been selected from a large number of dissertations and contain the gist of what is known upon the subject.

As, in the foregoing historical study, I have had no guide beyond my own literary notes, the task has been a laborious one, and one which I feel has been but imperfectly accomplished. If, however,

* William Heberden, "Commentaries on the History and Cure of Diseases," London, 1802; also published in Latin, chap. 101, p. 472.

† *Op. cit.*, chap. 24, pp. 135, 136.

‡ "Traité des mal. des fosses nasales," etc., Paris, 1804.

"Cours d'anat. méd.," etc., Paris, 1804, t. iv, art. "Nez," p. 491.

‖ "Praxeos medicæ universæ præcepta," Lipsiæ, 1818, pars ii, vol. i, sect. i, cap. 2, § viii, p. 162.

△ *Op. cit.*, p. 547.

◊ "Am. Journ. of the Med. Sci.," January, 1886.

I shall have rescued from oblivion a portion of the older literature of the subject, or shall stimulate others to more elaborate and exhaustive research, my labors will be abundantly repaid.

The preparation of both historical sketches would have been impossible were it not for the unrivaled facilities for literary research offered by that monument of industry, the library of the Surgeon-General's Office at Washington; and I desire to acknowledge my indebtedness to the authorities of that institution for special privileges in gaining access to many rare works which otherwise would have been inaccessible.

Paper.

HAY FEVER. ANALYSIS OF FORTY-FOUR CASES TREATED BY THE WRITER, TOGETHER WITH THE RESULT OF TREATMENT.

JOHN O. ROE, M. D.

ON considering the cloud of nebulous theory which has surrounded the subject under consideration, and the mass of speculation which has been propounded by the numerous writers on this subject during the past four years, it is with some hesitation that I have presumed to occupy any portion of your valuable time with a further discussion of this subject. It is my purpose, however, not to enter into a theoretical discussion of the subject, or to review the various opinions held by different writers, but to give a brief analysis of the cases which have come under my observation, and to present the conclusions deduced from such observation.

I have purposely retained the term "hay fever" to designate the affection under consideration, for the reason that it is a universally accepted term, and that all fully understand what is implied by it. In applying to the affection the more scientific terms that have been proposed, we have, in many instances, to explain the meaning of the terms before their significance is fully understood. In some instances the names proposed for the affection imply a mere hypothesis.

Since I first observed that this affection was related to nasal disease, I have treated forty-four cases, including the hay-fever season of last year. It is often true that an erroneous conclusion is drawn from the observation of a single case of a disease, because it may present phenomena of an unusual character. The number of cases which I have treated, although not large, is, however, sufficient, I

think, to direct us to quite definite conclusions, as I have been particularly careful to observe and systematically record them.

The study of these cases has substantially confirmed the opinions which I expressed in my first article on this subject in February, 1883,* although in some respects my views have been more or less modified. While, as you already know, Dr. Daly † was the first to call attention to the clinical connection between hay fever and nasal diseases, the writer was the first to explain the relation of cause and effect between them, through the correlation of the vaso-motor or the sympathetic nervous system, and to point out the value of the galvano-cautery in the treatment of the nasal disease.‡

Of the 44 cases I now report to you, 27 were in males and 17 were in females, the ages of the males ranging from 21 to 51, and of the females from 19 to 58. Of the males between the ages of 20 and 30, there were 6; between 30 and 40, 13; between 40 and 50, 4; and between 50 and 60, 4.

Of the females between the ages of 15 and 20, there was 1; between 20 and 30, 7; between 30 and 40, 3; between 40 and 50, 5; and between 50 and 60, 1.

Of the 27 males, there were 5 farmers, 5 merchants, 2 railroad engineers, 2 real-estate dealers, 1 physician, 1 lawyer, 1 banker, 1 clergyman, 1 insurance agent, 1 contractor, 1 book-dealer, 1 hotel clerk, 1 superintendent of public instruction, 1 commissioner of pensions, 1 grocer, 1 carpenter, 1 traveling salesman. Of the 16 females, there were 1 vocalist, 1 music teacher, 1 school-girl, and 1 worker in a shop, and the remaining 12 had no occupation other than their domestic duties. Of these 44 patients, 7 had been suffering for 10 years, 7 for 8 years, 6 for 4 years, 4 for 2 years, 3 for 14 years, 2 for 6 years, 2 for 12 years, 2 for 15 years, 2 for 20 years, 2 for 30 years, and 1 each for 3, 7, 9, 11, 13, 16, and 17 years.

The date of the commencement of the attack varied from May 1st to August 21st. It is a significant fact that in every instance

* "The Pathology and Radical Cure of Hay Fever, or Hay Asthma," "N. Y. Med. Jour.," May 12, 19, 1883. See also a second article on the same subject, "N. Y. Med. Jour.," May, 3, 10, 1884.

† "The Relations of Hay Asthma and Chronic Naso-pharyngeal Catarrh," "Arch. of Laryngol.," iii, 1882, p. 157.

‡ Since that time both Dr. Daly's observations and my own have been fully confirmed by many careful observers and writers on this subject both in this country and in Europe, among whom are Hack, Herzog, Hering, Böcker, Bresgen, Massei, and McBride, of Europe, and Mackenzie, Bosworth, Allen, Sajous, Ingals, Robinson, and Seiler, of our own country.

active symptoms of the affection subsided soon after the appearance of frost. The connection between the cause of the irritation and the frost will be alluded to further on.

In nearly every case there was a special proclivity to repeated and successive colds in the head, with more or less nasal obstruction. In several instances the attacks dated from a particular year in which the patient had taken, during the summer months, *an exceedingly severe cold in the head.* About one fourth of the forty-four patients —from the fact that they were subject to repeated colds in the head —considered their hay fever, for the first two or three years, simply an aggravated form of their accustomed colds.

In several instances, on interrogating the patients regarding the nasal passages and asking whether they suffered from so-called nasal catarrh during the remainder of the year, they stated that they were entirely free from any such difficulty during the remainder of the year, except an occasional cold in the head. An examination of these cases revealed in every instance, however, disease of the nasal passages, and areas so sensitive that the slightest touch of the probe excited sneezing, and in some instances well-marked hay-fever symptoms.

In all but 5 of these 44 cases I found inferior turbinated hypertrophy. In these 5 cases there was an excessive vascularity of the parts and dilatation of the cavernous sinuses, which were collapsed when free from irritation so that the passages were entirely clear, but by the application of the slightest irritant they would at once become distended sufficiently to occlude the nostrils. In 19 cases, deviation of the septum was found with angular projection from the deflected side. In 11 cases there was deviation to the left side, and in 8 to the right. In 23 cases the middle turbinated bodies on one or both sides were found hypertrophied and projecting against the septum. The location of the special points of sensitiveness was by no means constant. They were usually found over the region of the greatest amount of hypertrophy. In very few instances were they confined alone to the posterior end of the turbinated bodies, or alone to the anterior inferior turbinated bodies. Not only in a majority of the cases were they not confined to the turbinated bodies, but in most of the cases the septum was quite as sensitive as any portion of the turbinated bodies. In some instances the septum was more sensitive, and sneezing and hay-fever symptoms were more readily developed than in any other portion of the nose.

The sensitive areas of the septum were in a majority of the cases

over the lower and posterior part. In one third of the cases, however, small, rounded, pad-like masses of hypertrophied tissue were also found on the middle of the upper portion, and so exquisitely sensitive that violent sneezing would be induced by the lightest touch of the probe. In some other cases, every portion of the septum was exquisitely sensitive.

In 33 of the 44 cases, dust was found to be an exciting cause, while in 26 of these 33 cases it was given as the principal cause. Rag-weed was an exciting cause in 15 cases, in 9 of which it was the principal cause. In many cases irritation was also produced by other substances, as the fumes of matches, coal-gas, new-mown hay, and the pollen of flowers, especially of roses. In some cases an attack could be caused by a large number of different substances.

So positively were many affected by the pollen of rag-weed that they could predict the date of their attack by the time of the ripening of the weed. If for any reason the season was backward, and the rag-weed retarded in ripening, their attack would be correspondingly delayed.

Of the 44 cases, 32 of the patients were attacked with asthma. In six it came on at the beginning of the hay fever, in thirteen after the affection had continued for about two weeks, while in the remainder it appeared only after the greater portion of the irritation in the nose had subsided.

The presence of the dust of dried hay at any time of the year would excite in some a temporary attack of hay-fever and asthma, and ten were thus subject to asthmatic attacks brought on by the inhalation of certain substances which the patients recognized as especially irritating to them, such as the fumes of a sulphur match or coal-gas.

In some cases, asthmatic attacks were associated with each fresh cold in the head, while in some others, asthmatic attacks were excited by the inhalation of these substances without the occurrence of a coryza. It is a noticeable fact in these cases that those most sensitive to the inhalation of foreign substances, and those in whom the asthmatic attacks were excited with less apparent irritation in the nose, were those who had been long sufferers from this affection; while in those who had been sufferers but a short period, it was exceptional that asthmatic attacks were excited without a more decided irritation of the nasal passages. In every case where there was marked disease in the nasal cavity, there was also more or less hyperæmia of the larynx and pharynx, and in some cases this

amounted to a chronic pharyngitis, laryngitis, and bronchitis. As a rule, the amount of pharyngeal, laryngeal, and bronchial inflammation depended upon the severity of the attacks, the amount of chronic disease existing in the nasal passages, and the length of time the patient had been subject to hay-fever.

Of these 44 patients, but 12 had what is termed a nervous temperament, while 9 were distinctly phlegmatic. The others were of intermediate types of temperament, the classification of which is somewhat arbitrary. Four of the patients who were distinctly nervous were entirely free from any nervous excitability before their first attack of hay fever; but this condition developed afterward in a corresponding degree to the severity of the subsequent attacks, and the systemic depression that followed them corresponded in nearly every instance to their severity or to the number of years the patients had been sufferers.

In order, therefore, for the production of this affection, we must have, first, a localized disease in the nasal passages, rendering the tissues unduly sensitive to local irritation, and, secondly, an external irritant brought by the atmosphere in contact with the sensitive tissue. Irritation reflected to the nose from other organs which may be diseased and susceptible to local irritation can not properly be classed with the affection under consideration, but should be considered with the diseases of the parts from which the irritation is reflected. It is on account of a lack of discrimination that hay fever is so often confounded with all the other affections of a reflex character in which the nares and bronchi may be involved.

The sequence of events in the evolution of this affection, it is believed by the writer, is as follows: A continued irritation of the nerve-filaments in the nose causes the nerve-ganglia, or centers from which these nerves are derived, to become unduly active, and in due time abnormally so. This abnormal activity is in turn reflected to the other nerves radiating from this center, and these nerves in turn take on increased activity, which is made manifest in increased vascularity of the parts which they supply, owing to the diminished control of the afferent vessels. This activity of the nerve-centers increases in proportion to the degree or length of time that the primary irritation continues, and finds expression in a corresponding increased vascularity and irritability of the parts to which these nerve-filaments go. Now, inversely in proportion to the increased activity of the center is the degree of irritation required to excite it.

At the beginning of the attack of hay-fever a strong irritant is

required to start the train of symptoms. After a time, as the nerves and the nerve-centers become more sensitive to impressions, a lesser irritant is required to start the same train of symptoms, and the influence of the irritation is also extended to other connecting nerve-centers and the parts supplied by them. After a time, also, the parts that were secondarily irritated become primary points of irritation, and act in conjunction with the primary seat. This train of symptoms can be traced in nearly every case. At first we see simply an inordinate vascularity of the parts directly irritated, next we have the same condition in all the parts to which this ganglion sends its nerve-filaments—as the conjunctive lacrymal apparatus and the larynx and pharynx—then in the next ganglion in the chain and the parts to which it sends nerve-filaments, and so on till every nerve-center of this chain becomes involved in this undue activity, and the point is reached when the centers controlling the vascular supply of the trachea and bronchi are involved, culminating in a chronic bronchitis. This clearly explains why asthma is readily induced by the inhalation of substances that may have ceased to be irritating to the tissue in the nasal passages, when their susceptibility has been removed by appropriate treatment. Those writers who have been led to believe that there is no connection between nasal disease and this asthma overlook the influence which the disease in the nose has exerted in bringing about this condition.

It can not be denied that the ganglionic centers of persons having a susceptible nervous organization are more readily affected by such local irritation than those having a less susceptible organization, but I do not believe that such natural susceptibility is necessary in order that this train of symptoms may be started.

The neurotic habit, as it has been termed, is therefore imaginary, and not a necessary factor in the evolution of this affection; but, with the continuance of the affection, a neurosis, as above explained, is developed that is as much secondary to the primary disease in the nose as the nervous disturbance resulting from an abscess in the ear is secondary to a diseased tooth that may have been the direct cause of the abscess by the irritation of the otic ganglion. Hack recognizes this factor when he says: "It certainly can not be determined, *a priori*, how many of the symptoms may be attributed to a neurotic condition, for, in not a few cases, the neurasthenic symptoms may be secondary, produced by the depressing influence of hay-fever attacks."*

* "Ueber Catarrhus autumnalis und Heufieber," "Dtsch. med. Woch.," xii, 1886, p. 143.

Even in choreic affections Dr. Jacobi observes that "there is not necessarily a direct connection between these irregular choreic symptoms of local origin and general neurosis—at least, the former do not depend upon the latter." *

As this ganglionic involvement continues, the patients become susceptible to minor irritations from sources quite different from those which were at first required to excite an attack. This is shown by the fact that in every case the patient soon became susceptible to the inhalation of lesser irritants throughout the year, which before the onset of his hay fever would have had no effect whatever upon him.

An engorgement of the turbinated bodies that may be the result of an irritation reflected to the nose from a diseased tooth or a diseased ear, can with propriety be termed a "vaso-motor coryza," but is not to be classed with the affection termed hay fever. This affection is one distinctly excited by irritation applied to some portion of the lining membrane or tissue of the respiratory track, and taken there in the inspired air. That this is the invariable direction from which the irritation comes is shown by the fact that in every instance all the phenomena will cease immediately on the removal of the patient to a place where the air is entirely free from all foreign substances, no matter how hot the atmosphere or bright the sunlight. The local irritants that are carried in the atmosphere during the summer months are numerous, but it is unquestionable that the most virulent irritant to this diseased nasal tissue is the pollen or spores of plants, the pollen of some plants being more irritating to one individual than to another, and *vice versa*. Why this is so we do not know. It is according to an unexplained law, which, if we knew, would explain why some foods, medicines, etc., can be taken by some persons with the happiest results, while to others they are decidedly poisonous. It is a significant fact that, with the appearance of frost, the active symptoms of this affection cease. The only conclusive explanation of this is that the exciting cause is a vegetable substance which the frost affects by destroying its virulence and rendering it inert.

The conditions of temperature or sunlight are not direct excitants of attack; where they aggravate the attack it is by lowering the resistance of the person to the action of the irritant, in the same manner that, as we lessen the resistance to a galvanic current, the electrical action becomes correspondingly stronger.

* "Am. Jour. of the Med. Sci.," April, 1886, p. 518.

No small amount of the relief obtained at sea-side or mountainous hay-fever resorts is due to the bracing effect of the atmosphere and changed mode of living, which simply increase the inhibitory force of the whole system, as well as to the comparative freedom from dust, pollen, and other irritating substances. The relief during the attack that is often afforded by drugs, or even, as in some cases, by a single dose of opium, is due more to the inhibitory effect of the drug in arresting the transmission of the irritation than in the benumbing of the local sensibility.

Mental emotions have a marked effect on the inhibitory action of the system, and especially on the part on which the mental effort is concentrated, and have the same effect on the vascular control of the part as irritation of the part—that is, to dilate the capillaries and increase the vascular supply. In this manner the connection between the mental association of a hay-field or roses and a coryza is accounted for.

The direction in which this irritation may be reflected or carried is in every instance, like the electric current, in the line of the least resistance. If one set of ganglia is weaker and has less inhibitory power, it is in that direction that the irritation will be transmitted. Thus, in one instance the irritation may be expressed in a supra-orbital neuralgia, hemicrania, or megrim; in another, in facial spasm, choreic symptoms, or epileptiform seizures; while in others it may find expression in a coryza, a pharyngitis, a laryngitis, a bronchitis, or in sneezing, cough, laryngeal spasm, or asthma.

We come now to perhaps the most interesting and important part of the subject—the question of the nature of the treatment, and the success attending it, for, without the latter, our other studies are without value.

The only rational and successful treatment of this affection is to restore the parts involved to a normal condition. If we find a preponderance of local disease in the nose, we must of course restore the nose to a normal condition. If we find a limited amount of disease in the nose, but the resistance of the system so lowered from any other cause as to permit a ready transmission of the irritation to the nerve-centers, we must of course restore the system to a normal condition, and thus increase its resistance to local irritation. In some instances in which the irritation of the nose is slight and of short duration, the use of bromides and of the so-called nerve tonics, or a sojourn at a sea-side or mountain resort, will increase the inhibitory force sufficiently to give entire relief. In some cases of this

kind where the affection is slight, the use of cocaine in benumbing the terminal filament of the nerve-fibers—thus cutting off the local irritation in the nose—is sufficient to arrest an attack. The effect of cocaine, however, in nearly all cases is merely temporary, for, as soon as the effect is gone, the symptoms return with renewed vigor from the fact that the secondary effect of cocaine is in nearly all cases that of a slight irritant.

In a number of cases in which I have resorted to the use of cocaine, when patients have consulted me during the attack, the relief was almost instantaneous, but unfortunately the application of the drug must be frequently made, and in sufficient quantities to produce some constitutional effect, and, as this effect is depressing to the system in a marked degree, its use during the entire hay-fever period can not be continued.

In the majority of cases there is so much local disease in the nose that no amount of tonics can increase the inhibitory force of the system sufficiently to overcome the affection. The only way to effect a radical cure in these cases is to remove by local treatment the conditions in the nose, and in other portions of the respiratory tract that have become secondarily involved, which render the individual so highly susceptible to local irritation.

The plan which I have followed in the main has been to remove the redundant tissue in the nose by the cold-wire snare before employing other agencies; then to correct any deflections of the septum and to remove all bony outgrowths; next with a probe to seek out sensitive areas and cauterize them with chromic acid or destroy them with the galvano-cautery. The plan of "superficial alteration" of the nasal mucous membrane by the galvano-cautery, which is advocated by Dr. Sajous,* has not given me the satisfactory results he claims for it. It has been by means of deep cauterization that I have obtained the best results. I do not wish it to be understood that I recommend the wholesale destruction by the galvano-cautery of all the tissues of the nasal passages that may contain limited sensitive areas, whereby unnecessary cicatrices may be caused, and, as Dr. Cohen† very justly remarks, thus prepare the ground for less benign diseases in the future. The inordinate desire which is often shown to completely exterminate with the galvano-cautery every turbinated body possessed by persons subject to hay fever should be condemned, not only on account of the irreparable damage that

* "N. Y. Med. Jour.," Dec. 6, 1884, p. 629.

† "Am. Jour. of the Med. Sci.," xci, 1886, p. 310.

is done, but because, as Dr. Beverley Robinson * remarks, structures are often removed which are in reality inoffensive.

There are two plans of deep cauterization which I adopt according to the requirements of the case. When there is connective-tissue hypertrophy, I make linear incisions with a fine cautery point well down to the bone. In this manner we cut off the sensitive nerve-filaments, and at the same time leave ample mucous membrane to spread over the surface destroyed, and, as the deep cicatricial tissue contracts, the remaining tissues are firmly drawn down over the turbinated bone, whereby both the sensitiveness and the vascularity are obliterated.

Another plan, and one which I adopt in cases where there is great distensibility of the cavernous sinuses without interstitial hypertrophy, is to attack the part when in a distended condition, employing a long and very fine platinum point, and thrusting it when heated deeply into the tissue. We can then sweep the point about to any desired extent and destroy the cavernous sinuses underneath by making but one small opening in the surface where the point is introduced. The septum is dealt with according to the plan of making linear incisions when hypertrophy exists, and the destruction of limited areas found to be sensitive. But for the *superficial alteration* of the mucous membrane, chromic acid is by far preferable to any other agent. Not only should every portion of the nasal cavity receive the requisite attention, but the condition of the pharynx, larynx, and bronchia must not be overlooked. It is not uncommon that enlarged tonsils will keep the turbinated bodies in a condition of chronic hyperæmia. Dr. Jacobi very truly says: "Many a rhinitis has to be treated in the pharynx, and many a pharyngitis in the nose; and both may never get well unless the enlarged and abnormal tonsils have been removed or resected." †

It is often also that the neglect to cure a chronic bronchitis accounts for the reappearance of hay asthma after the susceptibility of the nasal passages to irritation has been entirely removed.

The result attending these cases is as follows: 36 of the 44 patients have been cured; 4 were not relieved owing to imperfect treatment, due to the neglect of the patient; and 4 I have lost sight of. Of the 36 who were cured, 20 have remained exempt from the first year of treatment to the present time—1 of them for 9 years, 1 for 7 years, 1 for 5 years, 2 for 4 years, 6 for 3 years, 5 for 2 years, and 4 for 1 year. The remaining 16 of the 34 had some

* "Med. News," xlix, 1886, p. 59.

† *Op. cit.*, p. 522.

slight irritation about the nose and eyes on hot, dusty days during the first season following treatment. This was found to be due to some remaining disease in the nose, the treatment of which has rendered them exempt since that time.

From a study of these cases I am led to the following conclusions:

1. That all cases of hay fever have their initiatory lesion in a diseased condition of the tissues of the nasal fossæ.

2. That the disease of these tissues induces, in the ganglionic centers connected with them, an abnormal activity, which is reflected to other tissues and organs.

3. That the sensitive areas in the nose are not confined to any particular locality, and that there are no zones in the nose that when irritated invariably produce the same manifestations.

4. That the direction in which the irritation is reflected is, like an electric current, always along the line of least resistance, and that from the same region it may be reflected in one direction at one time, and in the opposite direction at another time.

5. That the disease in the nose may produce disease in other portions of the respiratory tract, which may become independent centers of irritation.

6. That the affection distinctly recognized as hay fever is due to the effect of a local irritant, brought by the atmosphere in contact with the sensitive regions of the air-passages.

7. That the affection is not *per se* a neurotic disease, nor necessarily associated with a nervous temperament, although persons having a highly nervous temperament or a neurosis are much more susceptible to the influence of a local irritant.

8. That the neurotic condition which is often regarded as a cause of hay fever is itself often developed as the result of the local irritation.

9. That by carefully correcting all abnormal conditions found in the nasal or other portions of the respiratory passages, and the use of such systemic medication as may be required to remove any associated or consequent general derangement, we need not fail to cure hay fever.

Discussion.

Dr. C. E. Sajous, of Philadelphia: I am especially interested in Dr. Roe's paper, and particularly because it gives me an opportunity to report my experience with hay fever during the past year. You will remember that my friend Dr. Morgan, of Washington, asked us at the last meeting

of the association to give our experience regarding this subject. I did so frankly, having had a limited number of cases in which the treatment had been satisfactory the preceding year. In the light of my present experience, superficial cauterization can only be of permanent benefit in light cases. In serious cases it can only produce temporary relief. A number of patients treated with success two years ago returned to me, and then with deep cauterization I obtained favorable results. Last year I had unvarying success with my cases. I have not had to regret the treatment in one of them, and I think it is because I have come to consider superficial organic alteration as merely palliative in complicated cases, while deep cauterization is curative. Of course, this is to be aided by previous eradication of hypertrophies, bony growths, polypi, etc., as outlined by Dr. Roe.

Dr. Mackenzie: At the last meeting I freely expressed my views on the subject of so-called "hay fever," in a paper which has since been published in the "Transactions," and I will therefore not repeat what I said on that occasion. As you all know, I regard this disease as a neurosis. The nasal disease associated with it may be its primary cause, may be a secondary phenomenon, or may be purely accidental. The theory which attributes "hay fever" always to disease of the nasal passages is, I think, unsound and insufficient. There are cases in which there is no apparent nasal affection whatever. When I set out to investigate this subject, I was inclined to think, with Dr. Daly and Dr. Roe, that there was always some well-defined nasal affection present; while the existence of a nasal lesion in the great majority of cases must be accepted as a clinical fact, it is not always the initial lesion, but is not infrequently secondary or accidental. In the management of this class of neuroses we should carefully distinguish between two sets of cases—namely, those in which the nervous system is just beginning to suffer, and those in which it is more decidedly involved or in which it is the starting-point of the neuro-vascular disturbances. To illustrate: A patient with disease of the nose (or other respiratory lesion) suffers from paroxysms of cough, asthma, or some other affection referable to a reflex agency—some other "reflex neurosis." There are no other signs of a disordered nervous system. Perhaps this is the sole symptom for which he seeks relief. An examination of the nasal fossæ is made, disclosing a congested or catarrhal condition of the mucous membrane, a nasal polypus, or a deflected septum; and, on the removal of the local affection, the asthmatic attacks cease, the cough is dissipated, and the patient is restored to apparent health without other remedial measures. Now, what is the explanation of this curious relationship? When we consider the fact that hundreds of this patient's neighbors suffer from the same nasal affections, but that only a comparatively small proportion are affected with similar reflex troubles, it seems impossible to escape from the assumption of an abnormally excitable nervous apparatus and its constant irritation by the pathological condition in the nose. It is manifestly

unwarrantable to maintain that there is anything in a nasal polypus, an hypertrophied membrane, or a deflected septum to cause asthma and allied affections; but, in the absence of more definite knowledge, it is reasonable to infer that such an event probably occurs through the intervention of a more central cause. The explanation suggests itself that in this particular case the nasal passages may be the sole avenues through which the nerve-centers are influenced, and that, with the removal of the irritant and their consequent physiological rest, the disorder has been apparently, perhaps actually, dissipated. Let us follow this individual further in his life history. Perhaps the relation of his cough to the nasal affection has been unrecognized. In a little while, asthma is added to his disease; later on, affections of the eye, the ear, and other organs develop, with various symptoms referable to a disordered nervous system—he has no longer one troublesome reflex symptom, but a dozen. He consults his physician, and, if it is in the summer-time, is told that he has "hay fever," and that pollen is the cause of his trouble. This is no hypothetical case, but the narrative of *one* way in which the nervous system may be affected in the sympathetic affections of the respiratory tract. The first thing to determine, then, in a given case of nasal reflex neurosis, is as to whether the nervous phenomena are due primarily to respiratory irritation, to central causes, or to disease in other organs of the body—whether the symptoms referable to the respiratory tract are primary or secondary, and, if they are primary, to what extent the nervous system is involved. The class of cases in which relief or cure may be expected from local treatment alone is that in which the respiratory membrane is the primary seat of the disease, and in which the nervous system is not decidedly involved. In this set of cases—or, to look at the subject from another standpoint, at this *stage* of the disease—are included a number of the simpler forms of so-called nasal reflex neuroses. At this stage, the removal of a nasal polyp may cure a troublesome cough, cauterization of the mucous membrane may dissipate an inveterate hemicrania, and so on. Even at a later stage, when the group of symptoms commonly known as constituting "hay fever" develop, it may be possible, by securing physiological rest for the nerve-centers, to give temporary and even permanent relief. But, when the central nervous system becomes more profoundly impressed, when nearly every organ of the body seems to be included within the arc of the neuro-vascular disturbance, when pronounced structural changes occur in different parts of the respiratory and other systems, it is manifestly unnatural to expect that the disease may be cured by local measures alone.

I do not desire to depreciate the value of the cautery and other local measures, but I wish to insist upon the fact that there is a class of cases in which their use is wholly unnecessary. In my last year's experience, it so happened that several cases of unusual severity came under my care in which there was no well-defined nasal disease. No local treatment was used beyond the ordinary cleansing of the passages, and the patients

were treated on the principles laid down in the paper which I read before this association last year; and I think the results were as good as in any previous year, if not better. Reference has been made in the discussion to deep destruction of the cavernous bodies. Operators seem invariably to set out with the idea of *extirpation* of these bodies. The total extirpation of the corpora cavernosa is practically an impossibility, and, even if it were practicable, would be warrantable only as a last and desperate resource. I have rarely found such procedures necessary, and I believe that I accomplish an equally good, if not better, result by operating on a somewhat different principle. Having mapped out the area of most pronounced vascular disturbance, I make a stellate incision through the mucous membrane and the cavernous body with the cautery-knife. The vessels in the pathway of the incision become obliterated, a star-shaped cicatrix results, and the mucous membrane and the turbinated tissue become, so to speak, bound down or depressed upon the bony wall of the nostril. In order to avoid extensive sloughing, the incisions may be made at different sittings. By means of this method a sufficient patency of the nostril is secured, the erection of the turbinated bodies is brought under control, and the patient escapes with a comparatively small loss of function. I take this occasion to correct a false impression which seems to have gone abroad concerning my views of the sensitive areas of the nose. It seems to be the belief of many that I regard the posterior end of the inferior turbinated body and the septum immediately opposite as the only points from which pathological nasal reflexes take their origin; but, if my publications on this subject are read, it will be seen that all I maintain is that, while all portions of the nasal mucous membrane may be the starting-points of the reflexes, by far the most sensitive zone is represented by the area described by me in 1883—just as in the larynx, while cough *may* be produced by irritating any portion of its interior, both clinical and experimental observation demonstrate the fact that the interarytenoid commissure is the spot concerned above all others in the production of the reflex act.

Dr. Sajous: I should like to ask Dr. Mackenzie how, according to his view, so large a number of patients could be cured merely by local applications.

Dr. Mackenzie: I think I sufficiently considered that question in my communication to the association last year. I have also referred to it in the present discussion. The main principle is, briefly, this: By the removal of the local irritant, a condition of rest—physiological rest—is secured for the centers, which enables them to recover their normal tone. As long as this rest continues, the patient may be free from his trouble; but, set up the local irritation afresh, and his disease will return.

Dr. F. I. Knight: A proper question to raise in this connection might be the effect of the diversion of nerve influence upon the asthmatic attacks. A case was once reported to me in which the attacks were entirely aborted by the patient's accidentally breaking his leg. He

had been a sufferer for years previously. Another patient, who had suffered from hay fever for years and had undergone all sorts of treatment prior to modern methods without obtaining relief, met me last summer, and, exposing his conjunctivæ, said: "*Look* at me." I said: "Oh, yes, somebody has been cauterizing your nose." "No, sir." "You have been taking some strong tonics from Dr. Mackenzie." "No, sir, I have been to a mind cure." He had taken three or four sittings with a woman who professed the mind-cure method, and had come away entirely relieved. I have no doubt that other members have seen cases in which, through the influence of mental diversion, the attacks of hay fever have been ameliorated or entirely forgotten.

Dr. W. C. Glasgow: I think Dr. Mackenzie has raised a very important question in asking whether hay fever is ever cured by local applications. I do not believe it is. Local applications, cauterizing, scarifying, and burning may deaden the sensibility of the terminal ends of the nerves, but hay fever, I believe, is not cured by such treatment, for it is a general nervous disturbance. In all cases of asthma, constitutional remedies have to be used. For instance, iodide of potassium tends to hold the disease in abeyance while we correct any disorder of the terminal filaments of the nerves. A certain amount of relief may be obtained by deadening the ends of those nerves. But the asthmatic attack will continue until we have used some appropriate constitutional remedy. So I do not believe in this local treatment of hay fever. If we could destroy the nose, or turn its mucous membrane into a large cicatrix, perhaps it might tend to prevent a recurrence of the attacks. But, of course, no one would think that a very wise thing to do. There is no doubt that such local applications do tend to check the disease; I have seen them do so in many cases, but I have seen the disease recur after I had thought it was cured. Hay fever varies from year to year; one year most patients have the attack, the next year many escape; they may have it again the third year, or again escape it. So that it is hard to say when a case is cured.

Dr. Edgar Holden: I have always regarded this trouble as a neurosis, and I suppose the majority of the profession have accepted that view. When Beach Haven was established, I went there, not because of hay fever, for I never had anything of the kind, but because I thought it was a desirable place to spend the summer. For twelve consecutive years I spent the summer at Beach Haven, and saw there hundreds or thousands of cases of hay fever. My leaving the place came about in this way. On the 20th of August, about the time the patients with hay-fever began to have their attack, I took what I supposed to be an ordinary cold, and paid little attention to it. The next season I began to have the same kind of trouble as the other people, and at about the same time. It seemed to me impossible, but the third season, the twelfth year after I had first spent the summer there, I had so severe an attack that I left Beach Haven, and have not had any symptoms of hay fever since.

Dr. F. H. Hooper: I regard hay fever as a neurosis, and treat it according to the rules laid down by Dr. Mackenzie. Whatever its nature may be, local treatment certainly does a great deal of good, especially in children. I prefer chromic acid, which, together with tonic treatment and the application by the patient of a spray of a two-per-cent. solution of cocaine, gives great relief, if it does not actually abort the attack. I have now a patient who has suffered all his life with the severest form of hay fever, and yet, until he consulted me, his nose had never been examined. In the right nostril I found a sharp ridge on the septum, which came in contact with the inferior turbinated body. There was a similar ridge in the left nostril, but not so prominent. With the exception of these ridges, there was nothing abnormal in either nostril in the way of hypertrophied tissue that required operative treatment. The ridges were removed, the tissues in the nose were cauterized superficially, and general tonic treatment was employed, with the result that the patient has been perfectly comfortable during the month of May, which has always been most annoying to him in previous years. His severe attack comes on in the middle of August. I doubt if we can effect a permanent cure, by either local or general measures, of the severe forms of hay fever which come on late in the season, but the treatment of the mild and early manifestations of the disease is very satisfactory.

Dr. J. Solis-Cohen: The discussion to-day has, I think, shown a tendency for the pendulum to swing in the other direction. The past three or four years it had swung well to the left; it is now coming around to the right. I think the views expressed by Dr. Mackenzie are very nearly the correct ones. It has been my experience that very few poor people, even in dispensary practice, are the victims of hay fever. I have always thought that, in addition to the neurotic element, high living had a great deal to do with it. A large majority of the patients whom I have seen have been persons who lived well, or persons who resorted more or less to stimulants to keep them up to their work. Take them to Beach Haven, or the Adirondacks, or any other place away from their work, where they can lead a lazier life, and they get relief from their nasal irritation. I have obtained benefit for such patients not only by giving them tonic treatment for the nervous system, but also by regulating their diet, permitting the use of little meat, seeing that they clothed themselves lightly, etc. I think the more we look upon the disease as constitutional and the less as local, the nearer we shall get to the truth. It is undoubtedly a fact that a large number of these sufferers have an obstruction in the nasal passages. This, of course, we need to relieve. But there is a large number of them who have no nasal obstruction whatever, and certainly I should then look to some other cause for the affection. I am glad, very glad indeed, to see that local surgical measures are not in such favor as they have been during previous years. Dr. Roe said that several of his patients were not neurotic; that they were phlegmatic. Were they intelligent people?

Dr. Roe: Most of them were in active business. Two of them were lawyers.

Dr. Solis-Cohen: There was probably a cerebral element in those cases.

Dr. Roe: As I explained in my paper, I consider the affection termed hay fever the result of an irritation produced primarily in the nasal chambers, which irritation is caused by some foreign substance brought in contact with the sensitive areas by the atmosphere. An irritation reflected to the nasal chambers from some other portion of the body is not hay fever. Dr. Mackenzie seems to include under the term hay fever all reflected irritations from any portion of the body in which the nasal passages may be involved. There may be irritation in the nose due to a disease of the nose *per se*, which is not influenced by an external irritant. This disease may give rise to a variety of manifestations, such, for instance, as supra-orbital or facial neuralgia, epileptoid convulsions, or a variety of other neurotic symptoms, but these are not to be included in what we call hay fever, because they are not produced by an external irritant brought in contact with the diseased nose through the atmosphere. It is characteristic of hay fever that, soon after the patient is removed to an atmosphere in which this external irritant is entirely absent, all the symptoms of the affection speedily disappear. Regarding asthma, which is a very frequent manifestation of this affection, I do not consider it a necessary indication of a constitutional disease, as Dr. Glasgow appears to consider it, for the reason that asthma may be excited by a variety of purely local causes. It may originate from a primary irritation in the nose, exciting an irritation in the larynx and the bronchi, and these may subsequently become centers of irritation, as I have shown in my paper. These independent centers of irritation may then be excited by other causes coming from a different source. An irritation of the gastric plexus may even be excited by an overloaded stomach, which may excite asthma in persons with a sensitive center of irritation in the larynx or the bronchi. An irritation in the ear or other remote part of the body may in some cases excite asthma, but asthma produced in this manner is not characteristic of hay fever, although, when asthma is excited by irritation in the nares, the larynx, or the bronchi by something brought there by the inspired air, it is to be included under the head of hay fever. In regard to hay fever being a neurosis, I can find no evidence from my study of the affection to convince me that a neurotic condition of the individual is necessary to render him susceptible to it. It is true that many persons of a neurotic habit have hay fever. It is also true that many persons without the slightest indication of any neurosis have hay fever. The argument that because a person has hay fever he must necessarily have a neurosis, it seems to me, is entirely without foundation. In regard to the patients' condition in life, of which Dr. Solis-Cohen has spoken, it can not be shown from the classified list of occupations which I have that it has any special effect upon the development of this affection. It is true, however,

that persons who lead an outdoor life, and whose habits are such as tend to invigorate the system, suffer less often from hay fever than those who lead an indoor or indolent life, or are poorly nourished, or whose habits of life are such as to increase the excitability of the nervous system or to lower their vitality and powers of resistance to local influence. The latter are, as a rule, the most susceptible to hay fever; and in all such cases constitutional treatment is of the utmost importance.

Second Day—Morning Session.

BUSINESS MEETING.

The meeting was called to order by the President at ten o'clock, and the reports of officers and committees presented as follows:

Report of Secretary.—The minutes of the last regular meeting, together with those of the Council for 1886–'87, were read by the Secretary, who presented as his report the Eighth Volume of the Transactions of the Association.

By the authority of the Council two hundred copies of this edition had been ordered instead of one hundred and twenty-five, as in former years. The extra expense to the Association would be small, while the demand for the Transactions was rapidly increasing. The Secretary recommended that somewhat larger liberty in the distribution of the Transactions be granted, and explained in detail the terms of the agreement with the editor of the "New York Medical Journal," upon which the Transactions were published.

The Secretary also reported that a proposition had been offered to renew the arrangement made as before with the editor of the "New York Medical Journal" for the publication of the Transactions.

The report, including the proposition of Dr. Foster, was unanimously adopted.

Report of Treasurer.

THE AMERICAN LARYNGOLOGICAL ASSOCIATION
in account with D. BRYSON DELAVAN, *Treasurer.*
May 27, 1887.

Balance, May 25, 1886	$153.83	D. Appleton & Co., Transactions	$130.11
By annual dues and assessment, 1886–'87	336.00	Stenographer	75.00
By sale of Transactions, etc.	17.45	Printing	18.20
"New York Medical Journal," rebate for discussions	30.00	A. E. Foote	16.00
		Postage, expressage, sundries	27.90
			$267.21
		Balance on hand, May 27, 1887	270.07
	$537.28		$537.28

D. BRYSON DELAVAN,
Treasurer.

Audited and found correct.
MORRIS J. ASCH,
JOHN O. ROE.

Accepted.

Report of Librarian.—The Librarian, Dr. Thomas R. French, reported that interest in the library had continued unabated. The estate of the late Dr. Elsberg had contributed a nearly complete list of Dr. Elsberg's writings on laryngology and biology, and also 19 books and 122 pamphlets from his effects. These, however, were received too late to be added to the "Supplementary Catalogue" which was published in the Transactions of this Association for 1886. The supplementary catalogue contains 1 book and 136 pamphlets. These, together with the pieces received from the estate of the late Dr. Elsberg, made the total contributions for this year 20 books and 283 pamphlets.

The report of the Librarian for 1885 showed that the library then contained 34 books and 503 pamphlets. The additions of this year make the total contents of the library 54 books and 786 pamphlets.

A glance at the catalogue published in the Transactions of 1885, and the Supplementary Catalogue, published in the last volume of the Transactions, would show that the lists of the writings of many of the Fellows of the Association were incomplete, and that a number of the Fellows were not represented at all. In order to stimulate contributions from those outside of the Association, it was highly desirable that all of the Fellows should be represented in the published catalogue, and that the lists of their writings should be complete. The library had no funds with which to purchase books and pamphlets, and therefore all the matter which came into it must be donated. It was scarcely reasonable to suppose that outside interest would continue if the Fellows of the Associa-

tion did not invite it by contributing all of their own published books and articles. Accepted.

Report of Committee on the Congress of Associations of American Physicians.—The Chairman of the above committee, Dr. F. I. Knight, reported that the committee recommended that the American Laryngological Association unite with other special associations in the holding of a joint congress, and that the date for said congress be fixed for some time in September, 1888, to be precisely appointed by a committee of delegates from the various associations. Accepted.

Committee on Nominations.—The Committee on Nominations reported as follows:

For President.—Dr. Rufus P. Lincoln, New York.
For First Vice-President.—Dr. John N. Mackenzie, Baltimore.
For Second Vice-President.—Dr. Samuel W. Langmaid, Boston.
For Secretary and Treasurer.—Dr. D. Bryson Delavan, New York.
For Librarian.—Dr. Thomas R. French, Brooklyn.
For Member of Council.—Dr. E. Carroll Morgan, Washington.

[*Signed*] Wm. C. Glasgow,
Beverley Robinson,
S. H. Chapman,
Committee on Nominations.

Paper.

MYALGIA OF THE PHARYNX AND LARYNX.

By S. H. CHAPMAN, A. M., M. D.

MYALGIA means, of course, muscular pain. The name defines as carelessly affections of muscles as neuralgia does those of nerves. But, with the modern increase of knowledge of morbid anatomy, the name has become more and more limited in use, until, at present, it represents a few still imperfectly known affections.

I would still further limit the use of it to a peculiar condition of the muscular tissues of the chest and upper air-passages; a condition the cause of which is understood, but the morbid anatomy of which is still to be discovered.

All the muscular tissues which are directly involved in the respiratory act may be affected; but those usually so affected are the pectoral muscles, the muscles of deglutition, and those of the voice. The first and principal symptom of this condition, the symptom which leads patients to seek advice, is a sense of uneasiness in one

or more muscles of the chest or of the upper air-passages. This sense of uneasiness does not amount to pain, even on motion; in that respect it differs from both muscular rheumatism and neuralgia. But pressure upon it, as with the finger or some portion of the clothing, produces pain more or less acute.

In that respect it resembles the affections spoken of. The muscle affected shows no sign to touch, sight, sound, or thermometer, of the presence of disease. Adjoining tissues, not muscular, are not at all implicated in the process.

If the affected muscle is contiguous to an important organ, the invalid fears disease of that special part. Fears of heart disease and of cancer of the breast are unusually common, and are often the cause of seeking advice.

The second and equally important symptom is a sense of loss of power in the affected part. This is specially prominent when the muscles of one side of the chest or the muscles of deglutition are affected.

In the former case, complaint is made that the affected side does not inflate so much as the unaffected one. But the most careful examination in very many cases fails to substantiate any such condition. The affected muscles are as sensitive also to electrical tests as the unaffected. In the latter case, the condition is profoundly deceptive.

The pain on swallowing produces a natural shrinking from the act, and a partial loss of power is thus readily simulated.

Electrical tests can not be applied with advantage in such a location, and cocaine, affecting the superficial tissues only, does not aid us. But, after repeated trials with foods of different consistences, and on finding that the more fluid the food the less the difficulty of swallowing until the difficulty vanishes altogether, I have come to the conclusion that the pressure of solids on the passage down gives rise to the pain, which is similar in character to that produced by the pressure of the finger upon a muscle elsewhere. I have been able to verify this statement by pressure with blunt probes, and in this manner to locate the muscles affected.

In the worst cases of this description, the passage of bougies has been resorted to in order to eliminate the possibility of stricture of the œsophageal opening. In the majority of these cases also, there is an entire absence of any affection of the mucous membrane.

Negative evidence is furthermore given of the correctness of this conclusion in the fact that the disease affects at the same time some of the pectoral muscles. Laryngeal myalgia is far less frequent than

the pharyngeal, yet a sufficient number of cases are interspersed with others of this disease to enable us to diagnosticate and differentiate it.

The symptoms are a sense of fullness with pain on pressure, a feeling of constriction, and the sensation of uneasiness with loss of power, denoted by the adoption of a suppressed vocal intonation. At the same time there is entire absence of inflammation of any sort, and the co-ordination and strength of the laryngeal muscles seem to be perfect. I am not a sufficiently acute observer to have been able to discover whether the affection attacks single muscles or single groups of muscles in the larynx.

The third symptom in this disease is an irritable pulse, increasing to cardiac palpitation in the cases of long standing or of severity, and with it a faint cardiac systolic murmur is perceptible, reminding one of mitral regurgitation.

It has not, however, the accentuation of insufficiency, nor the loud, blowing character of the anæmic bruit; it gives one the impression of the scraping noise made by a ship passing through buoyant flotsam.

The fourth symptom is tenderness, more or less marked, in the region of the spleen, and, in cases of severity or of long standing, the spleen is found enlarged. The conclusion has been reached that this is a muscular and not a sensory condition, because, first, there is no actual pain, no neuralgia; second, the unpleasant sensation does not follow the location of the nerves; third, electrical treatment has no effect upon it; fourth, it does not seriously impair the general health. Usually patients complaining of these peculiar sensations are found to be in fair condition—do not show to a casual observer any marked depreciation of the general health.

The cause of this peculiar condition is the absorption of the germ poisons of moist air or of unsanitary drainage. In short, it is a species of blood-poisoning, affecting particularly the respiratory muscular system and the heart. The absorption of the poison takes place through the lungs, whence it is taken up by the blood, and is thence discharged into the muscular fascias. The direct irritation of the poison is the cause of the palpitation, and the presence of the abnormal substance is the cause of the unusual cardiac tone.

It is a poison of some virulence and of quick action, since the disease is seen to reach its full development within a few hours, and, under the influence of proper treatment, to disappear almost as rapidly.

Yet it is also capable of acting slowly—no doubt in greater attenuation—producing a chronic invalidism of some portion of the tract usually affected.

On account of the curable nature of the disease, it is impossible to give any data of the morbid anatomy of the parts affected, but the foregoing conclusion has been arrived at for the following reasons: 1. The presence of the disease beside malarial affections of all grades. 2. The presence of the disease beside diseases due to undoubted blood-poisoning, such as diphtheria and typhoid pneumonia. 3. The similarity of some of the symptoms to those of the graver diseases mentioned. 4. The indirect evidence from the absence of any real muscular or nervous disorder. 5. The rapid disappearance of all symptoms under an antimalarial germicide treatment.

The treatment which has proved the most effectual consists of inhalations of oxygen, of rapid saturation with quinine, especially of the form containing also salicylic acid, and of chloride of iron. Local treatment by counter-irritation, whether with blisters, iodine, mercury, or the moxa, has proved unavailing. Local treatment also of the throat has been of no service whatever, and the patient and prolonged use of the electrical current has proved equally useless. Immediate change to a different locality and atmosphere has been advised, and, where this recommendation has not been accepted, relapses have been sure to follow.

In closing, permit me to give four cases from my note-books which seem to be fairly representative of the different conditions observed:

Case I.—Patient seen in consultation because of peculiar symptoms arising during the second week of repair of a broken leg. He was a strong, large man of twenty-four years of age, suffering from palpitation and distress from inability to swallow freely, with a sensation of choking. He complained of soreness of the chest, and cringed when pressure was applied over the chest-walls in front and on the sides and to the larynx. Pulse, 110; temperature below 98° F. The symptoms had come on suddenly two days before, and had become gradually worse, and his general health was being depressed by them. Examination revealed no inflammation of the larynx or pharynx, though there was much pain on pressure low down in the pharynx. I found that the patient had been placed in a ground-floor room where there was a disused sink, and beneath which was no cellar. To facilitate ease of care of the patient, I had him removed to the second story on the south side of the house. Ordered oxygen and quinine in large doses, and the symptoms gradually disappeared during the following week.

Case II.—A gentleman, aged fifty-two, who looked robust, had consulted specialists in this and other countries for an apparent lung trouble with occasional unpleasant sensations in the throat. The chief symptoms on first examination were: moderately accelerated pulse with faint systolic bruit; pain on pressure localized to the right side of the chest over the second, third, and fourth ribs; a feeling that his collar was too tight or his neck, with pain in the region of the larynx when pressed; a tendency to use a small, soft voice, which became strong and natural again under excitement. He was quite sure that he suffered from both heart and lung disease. He acknowledged having had malarial fever once and dumb-ague at times, for the cure of which he had taken a sea voyage. He confessed that these symptoms were not always present, but usually came on suddenly while he was at his country place, and were not relieved except by change of climate. His wife and daughter had both suffered from malarial disease in one form or another. He was quite sure that the right lung was contracted and the inflation of the right side much less than that of the left. His appetite was good, and he felt strong otherwise; but he was too nervous to sleep quietly.

Examination showed no lung or pleural disease, and no laryngeal congestion or inflammation. Examination of the urine disclosed nothing abnormal. On going to his country place, I found the house surrounded by a dense wood, and consequently damp. To the right and close to the house also was a dark pool with spongy banks. I ordered change of climate, with quinine and iron, and recommended thinning of the grove and drainage of the pool.

This occurred in August, 1884. My recommendations were followed, since which time the health of the family has been good, and the patient has had but one slight recurrence of the affection—in April, 1886—the apparent result of a visit to the country to oversee the erection of a new building.

Case III.—A young lady, aged nineteen, who looked healthy, had a good appetite and digestion, but had been obliged to be careful to take soft foods for some weeks, on account of an apparent difficulty and pain in swallowing, had constantly an uneasy sensation in the throat, which did not affect the larynx. She had heard of consumption beginning in this manner, and was anxious about it on that account. Menstruation was regular, normal in quantity, and painless. There was no constipation. She lived on a high bank overlooking a sluggish stream running through a deep and narrow valley. The mists filled the valley at night in summer, and the house was damp; the drainage consisted of an untrapped earthen pipe extending into the river and below the surface of the water, the house-end of which was open, directly under the living room of the house. The autumn previous she had had typhoid fever. At the time of my visit in April her mother was suffering, as *she* said, from neuralgia of the head and stomach.

Examination disclosed a systolic bruit, with a pulse of 100, tempera-

ture normal, tenderness on pressure all over the chest, although she had not complained of any unusual sensations there; tenderness on pressure over the spleen, but no perceptible enlargement; great sensitiveness to pressure all over the pharynx, with no unusual appearance of the mucous membrane; larynx normal. A sugar-coated pill was given her to swallow, and seemed to give great pain on its passage toward the œsophagus, although it passed down with ease. The patient felt well except when attempting to swallow; but this had produced considerable nervous excitement and consequent exhaustion. I ordered quinine salicylate, fifteen grains daily, and fifteen minims of tincture of chloride of iron thrice a day.

In order to test the treatment upon what seemed to me an allied disease, I sent her mother directions to use the same treatment. There was in both cases an improvement after a few days, and with my special patient an entire absence of the disagreeable symptom and the bruit after a lapse of about three weeks. She has, however, had two relapses, milder than the original attack, which have been routed by the same treatment.

Case IV.—An overseer of large quarries which send so much freestone to New York, aged sixty and over, had used tobacco and stimulants in rather more than moderation. He had had for years attacks of chills, which were often accompanied by pains in the chest and throat. Latterly he had had no regular chills, but did not feel well. About a year before, he had tried to swallow a "junk of meat"—that was his expression—and thought it would choke him. Since then solids had seemed to hurt his throat, and he had lived on soft food as much as possible. He used to be very fleshy, but looked at the time of examination in good flesh and health. He had suffered from diarrhœa. Physical examination gave a pulse of 60, temperature normal; spleen perceptibly enlarged and tender. The urine gave bile colors and high specific gravity and excessive acidity, but no casts and no albumin. The pharynx looked somewhat inflamed, and the mucous membrane thickened. Pressure with a probe produced pain at the mouth of the œsophagus. Bougies were passed without difficulty, though with much pain. The larynx was normal.

Here was a case which seemed to be complicated by the tobacco-and-alcohol habit; but I determined to try first the treatment adopted for other uncomplicated cases of this kind, and to permit the continued use of the stimulants as formerly. The treatment varied from that already prescribed only in the addition of free and repeated inunction of mercurial ointment over the region of the spleen until a marked alterative effect had been produced. The process of swallowing became so much better after a treatment of three weeks that solids could be taken with very little difficulty or pain, but at this time I lost sight of the patient altogether.

If I have been able in the statement of these cases to give the salient points, you may, on consideration of them, conclude that the

point taken is a correct one—viz., that there is a more or less obscure affection of the muscles of the respiration and throat which may be called a myalgia malarialis.

Paper.

SENSORY AFFECTIONS OF THE THROAT.

By FREDERICK I. KNIGHT, M. D.

OF the neuroses of sensation in the throat, my experience has been chiefly with hyperæsthesia and paræsthesia.

Hyperæsthesia of the fauces is still unpleasantly familiar to all laryngologists, not so often from complaint on the part of our patients as from the annoyance and hindrance in the use of the laryngeal mirror and other exploration of the throat, though in marked cases the reflex movement of gagging is excited so easily by slight causes as to be of great annoyance to the patient, oftentimes such irritability existing that cleansing the teeth, opening the mouth, and even disagreeable sights are attended with reflex gagging.

In this form of trouble it has always seemed to me that practitioners did not consider the general condition of the patient sufficiently. Although we find the fauces, especially the soft palate, congested and relaxed, and probably the same condition of the upper part of the larynx, the worst of these cases are alcoholic or in the subjects of digestive derangement, the morbid disturbance showing itself not only in the mucous membrane of the throat, but also in that of the eyes and other parts. This form of hyperæsthesia will often yield to a withdrawal of alcohol and regulation of the diet without local measures, though astringents are often of great additional service.

For immediate help in conducing to toleration of the throat-mirror the local applications are uncertain, even that of cocaine, which is the best, often failing to abolish the reflex.

There is one class of patients, generally markedly neurotic, in whom a hyperæsthetic condition of the pharynx causes very distressing dysphagia. On examination, the pharyngeal mucous membrane is found to be rough, granular, from slight glandular hypertrophy. In these cases, while the local application of nitrate of silver may relieve, lasting benefit must be sought in tonics and general hygiene.

Of cases of paræsthesia I have had the usual number, cases in which the sensations complained of by the patient are out of all proportion to any apparent cause. These have been sensations of fullness, of pressure, pricking, burning, the globus hystericus, pain on speaking (causing phonophobia), or of some foreign body in the throat, such as a seed, a bone, a hair, etc. They have varied very much in intensity at different times, and have sometimes at intervals been wholly absent. They have been developed or increased by mental or physical fatigue.

In regard to the cause of this perversion of sensation, it may be regarded that in most cases an impairment of the general nervous system is present, though the exciting cause may be some local disease of the throat or a foreign body. I have seen a case within a week of a strong man, with only slight local disease in the nasopharynx, who suffers, especially when fatigued, as if from a hot iron in the region of the soft palate. He is subject also to a peculiar pulling sensation in the hepatic region, so strong that it prevents his lying on that side. Otherwise he is a robust man, weighing over two hundred pounds. The abnormal sensations often remain a long time after the removal of the apparent exciting disease or foreign body. I had a patient return to me a few days ago, complaining of the same old orange-seed which I had failed to find six years and a half ago.

Few explanations of the mechanism of these strange sensations have been offered, among which the ingenious one presented by Dr. Andrew H. Smith, at the meeting of this association in 1881, deserves special mention. He called attention to the fact that two sets of muscles attached to the hyoid bone acted antagonistically to one another, and that these two sets of muscles received their motor-nerve supply from entirely different sources; so that in case of slight paresis of one set, the other being left without sufficient antagonism, the hyoid bone and the structures connected with it would be approximated to the vertebral column, and a sense of something pressing backward would be felt.

I have not met, or certainly do not remember meeting, with paræsthesia of the larynx as the earliest symptom of pulmonary phthisis, as held by Jurasz and Gottstein.

My experience has led me to believe the prognosis in most cases of paræsthesia of the throat to be good, if treatment is faithfully carried out, though the course may be tedious.

The treatment of all neuroses of sensation, besides any local re-

pair which may be possible, must be aimed to correcting the constitutional vice, whatever that may be.

It is safe to say that failure in this often comes from following routine instead of seeking the special requirement of each case. For instance, the conditions of anæmia, neurasthenia, or lithæmia, may either of them be the underlying cause of a patient's trouble, and would require very different remedies, the last condition being often seriously aggravated by tonics and the routine treatment given the former.

Discussion.

Dr. J. N. Mackenzie: This is a very important subject, and I hope it will be thoroughly discussed. I fully agree with Dr. Knight in the estimate he has placed upon sensory neuroses of the throat, and in his insisting on constitutional treatment. Among the drugs that I have used, arsenic has been especially serviceable in controlling the excitability, which in the vast majority of cases is a reflex phenomenon. I have also occasionally found the constant current of electricity of service; it is useful likewise in hyperæsthetic conditions connected with chronic nasal inflammation, with sudden stoppage of one or both nostrils—a condition generally supposed to be due to gravitation of the blood to the more dependent portion. This explanation of the phenomenon has always seemed to me to be absurd. I believe it to be merely a vaso-motor phenomenon. To control it, I have used zinc, arsenic, and electricity, applying the latter carefully with one electrode over the nape of the neck and the other indifferently on the cheek, on the ala of the nose, or within the nostril. I think that marked relief has resulted from that treatment in several cases.

Dr. C. E. Sajous: I have seen two or three cases of sensory affections of the throat. In one case the patient had follicular pharyngitis. The follicles had not been destroyed, and the parts had apparently been restored to their natural condition, but the patient continued to suffer from a sharp, boring pain over the thyreoid cartilage. I noticed that the pain usually occurred during cold, damp weather. It was probably of rheumatic origin, but this supposition was not verified by treatment. The patient was accustomed to bathe in cold water every morning, winter and summer. He showed no mental peculiarity.

Dr. W. C. Glasgow: The neuralgias mentioned by Dr. Knight are considered in the malarious regions of the United States to be signs of malarial affection. I have also seen these sensitive conditions of the throat in connection with the gouty diathesis and with the condition called lithiasis. The pain is sometimes referred to a few follicles or to a single one. The follicles may be so concealed that it is difficult to find them. They are sometimes behind the palate or the tonsil, sometimes at the junction of those structures. The reduction of inflammation

in them is followed by subsidence of the neuralgia. A common cause of such neuralgia is rheumatism, and exacerbations occur at night. These affections are easily corrected if we ascertain the cause. Certain patients date the sensation from the swallowing of some foreign substance. One of my patients had swallowed a watermelon-seed about two years before, and had ever afterward believed that it was still in his throat. I found the peculiar sensation to be due to a hidden inflamed follicle near the pillar of the palate; when this was reduced, the disagreeable sensation disappeared. A local cause for the trouble may generally be found, although in some cases it seems to be the result of a constitutional condition, such as malarial poisoning, gout, rheumatism, or lithæmia.

Dr. CHAPMAN: I have very little to say in addition to the statements contained in my paper, but it seems to me that the discussion has shown a conflict either of terms or of the results of observation. We have heard a good deal about diseases of the mucous membrane and of the nerves of the throat, but the fact seems to have been overlooked almost entirely that there may be idiopathic diseases of the pharynx and larynx. On examining other parts of the body which are the seat of pain, we desire to make a differential diagnosis between affections of the nerves and those of the muscles; and, although difficult, it is always possible to do so. The region which constitutes my field of practice is very malarious, and we often see the severer forms of malarial disease manifest themselves in great anæmia, chronic infiltration of muscular tissues, and splenic affections. The pain in these cases we conclude to be due to intra-muscular pressure on the nerves of the parts affected, and not to a diseased condition of those nerves. Is it not, therefore, quite fair to consider the pain in the pharynx and larynx present in the majority of such cases to be also due to an affection of the muscles rather than of the nerves of these parts? Two arguments particularly favor this view—namely, the irresponsiveness of the nerves to the electrical current, and the sudden entire cessation of the pain under constitutional treatment.

Paper.

ON THE TREATMENT OF ATROPHIC RHINITIS BY APPLICATIONS OF THE GALVANIC CURRENT.

By D. BRYSON DELAVAN, M. D.

AT the second annual meeting of this association, held in 1880, a paper upon "Pharyngitis Sicca" was read by Dr. E. L. Shurly, of Detroit. It will be remembered that in this communication Dr. Shurly called attention to the use of the galvanic current in dry catarrh of the pharynx, and that he cited several cases in

which the application of that agent had been followed by decided relief. Afterward, in conversation with the writer, Dr. Shurly advocated the same treatment in atrophic rhinitis, and stated that good results had been obtained by him from its use.

As all will admit, there are few diseases which offer greater discouragement to both patient and physician than the one in question. The general verdict has been that, in a well-established case, the prognosis is bad; the truth of this opinion is confirmed by common observation. Any measure, therefore, capable of affording a fair promise of relief should be carefully studied, and all possible good from it realized and accepted before it is condemned.

With the intention of investigating the value of Dr. Shurly's suggestion, the writer about two years ago began a series of clinical experiments, the results of which have been so satisfactory that it would seem unfair to the originator of the idea, as well as to the method itself, that they should be withheld. It has seemed pardonable, therefore, to call the attention of the association for a few moments to the subject.

The application is made as follows: The positive pole of a constant current battery is applied to the nape of the neck by means of a flat sponge electrode. The negative pole is then applied directly to the nasal mucous membrane by means of an electrode especially designed for the purpose.

Dr. Shurly, in conversation with the writer, has insisted that, in order to obtain the best results, the electrode should be made of metal, and that the metallic surface should come into immediate contact with the Schneiderian membrane.

While not questioning the truth of this view, the writer has found practically that the use of such an electrode is inconvenient. In order to render the application of the nasal electrode simpler for the physician and more comfortable for the patient, he has been in the habit of using a piece of common copper wire, around which has been loosely wrapped a pledget of absorbent cotton. The size of the pledget must be carefully regulated to accommodate itself to the diameter of the nasal fossa into which it is to be introduced. The electrode thus made is to be saturated in lukewarm water, and, the nasal cavities having been thoroughly cleansed, introduced until its distal extremity reaches the retro-nasal space. The electrode may be made in two sections, and one of these introduced into each nasal cavity at the same time. The ends of the electrodes may then be joined to the connecting wire of the negative pole of the battery,

and the current gradually applied. The strength of the current should range for the average patient from four to seven milliampères, and the sittings should last from five to twelve minutes, or until the irritation caused by the current has been sufficient to provoke a slight watery discharge.

This proceeding is not accompanied by disagreeable symptoms if too powerful a current be not applied.

The immediate effect of the current is a sensation of warmth, followed by a tendency to increase of secretion. Later in the course of the treatment the symptoms in favorable cases are improved, sometimes slowly, sometimes with a fair degree of promptness. It is not alone in atrophic conditions that Dr. Shurly's method is valuable. Applied in certain cases of hypertrophic rhinitis, the writer has found it markedly beneficial, and his own experience, as well as that of several colleagues to whom he has recommended it in consultation, has encouraged him to regard it as a decided acquisition to the therapeutic resources at our command.

Of course, it is in cases of comparatively recent standing that the best effects are to be obtained. Persistent and patient treatment, however, in the graver class of cases, will give results which the writer has not seen equaled by the use of any other method. The main objection to the employment of the galvanic current is the amount of time required for its thorough and satisfactory application. It is to be hoped, nevertheless, that the value of Dr. Shurly's method may become more generally recognized, and that the relief of which it is capable may be afforded to the unfortunates who may require it.

Discussion.

Dr. De Blois: I was glad to hear Dr. Delavan's paper on this subject, as I have had opportunity to employ the method in two cases—one a case of hypertrophic, the other a case of atrophic, rhinitis. In the atrophic case there was also almost complete loss of smell and taste. The patient was under the treatment about six months, coming about three times a week. I did not measure the current, but I usually used from two to four small cells and the interrupted current. I had a positive electrode which I usually applied to the tongue; the negative electrode I made myself, passing brass wire through a small gum catheter, the terminal end being tipped with platinum. With this electrode I would start at the posterior part of the nose and draw the electrode along until it reached the anterior nares. The improvement was very great after two months. It is now six months, and there has been no return of his catarrhal trouble. His smell has become quite good; the taste has improved a little. The

hypertrophic case was not very much relieved. In that case there was considerable swelling at the orifice of the Eustachian tube, together with a good deal of deafness. I would pass the inductor entirely through and around these swellings, but very little improvement resulted.

Dr. F. I. Knight: I would ask the gentlemen what their experience has been with Gottstein's method. I am induced to do this because at first I was not inclined to give trial even to his method of treating atrophic rhinitis by plugging the nares. It seemed rather ridiculous in theory, but some time afterward, on putting it into practice, I found that in some cases it gave the greatest amount of satisfaction to patients and their friends, because of doing away with the disagreeable odor. I plug one nostril with absorbent cotton or plain cotton three hours in the morning, and the other three hours in the afternoon. The relief in some of the most offensive and intractable cases has been great in my hands, causing entire disappearance of the disagreeable odor. It seems to me that in these chronic atrophic cases the plug can do no harm. In fact, we try to excite irritation. I have never seen any irritation which was objectionable; although in some cases there has been sufficient irritation to change the character of the secretion and to make it less offensive, I have never known it necessary to discontinue the treatment.

Dr. J. N. Mackenzie: I have tried all sorts of plugs in the nasal cavity, and have found that they are excellent irritants, but nothing else. If you exclude the air from the inflamed surface in the acute variety of nasal inflammation you will give relief, but you can do that as well with a little piece of cotton. My experience with all forms of plugs in the nasal chambers has been bad.

Dr. F. I. Knight: I do not think it quite fair to suggest that any reasonable man would suppose he was curing an ozæna by stopping up the nose. That is not what Gottstein, Mackenzie, of London, or any man means when he says the odor is removed by this method; they mean, as I mean, that when the patient goes out afterward without any plug in his nose he is free from any odor. He is not obliged to go about with his nose plugged up. He wears the plug a few hours at home, and then, when he goes out into society without it, the disagreeable odor is not perceptible.

Dr. Hartman: Some years ago a paper was read before this association on the treatment of atrophic rhinitis. I then spoke of Gottstein's plugs, having myself tried them in a number of cases. I think the benefit is from stimulating the tissue and altering the character of its secretion. And I have no doubt that in the treatment with the galvanic current the same result is accomplished. It may be more thoroughly done in that way, but I believe that all the results which we get in the treatment of atrophic rhinitis come from stimulation of the parts and keeping them thoroughly cleansed from secretions.

Dr. Sajous: I observed that Dr. Delavan made use of the negative pole in the nose. Now, of the two poles the negative is the more

irritating, which goes to show that the benefit derived from galvanism is by stimulation. Further proof that the beneficial effect of treatment is due to stimulation is shown, I think, by the results of chromic acid, which I have employed in a few cases. I simply allowed the acid to be exposed to the air for some time, which gave me a saturated solution, and applied the latter over the atrophied surfaces about twice a week. In two cases so far it has given absolute relief. One of the patients I saw about seven months ago, and there had been no recurrence of her symptoms.

Dr. Roe: I quite agree with Dr. Mackenzie that Gottstein's plugs act as irritants. I have used them in several cases with no other effect than to keep the offensive odor in and to cause irritation instead of stimulation, which latter effect Gottstein alleges for them. The attempt to remove or prevent the odor of ozæna by these plugs suggests to me the quack who went about the country guaranteeing to cure otorrhœa at one sitting. His patients who were so speedily cured found shortly afterward that their ears had simply been filled with plaster of Paris to prevent the discharge from escaping. In atrophic rhinitis stimulation is what we want. I have recently used galvanism in several cases, and believe it to be, as Dr. Delavan has so clearly pointed out to us, the best stimulant we have in this affection, and in all these cases I have obtained most excellent results by its employment. In fact, in some most aggravated cases the patients have been so far benefited that they no longer suffer any unpleasant symptoms, and the odor has entirely disappeared. I have also employed, as a stimulant in these cases, with most excellent results, a weak solution of nitrate of silver (from five to ten grains to the ounce). The nose should be *thoroughly* cleansed and the solution applied, with cotton wound on a small probe, to every portion of the diseased membrane. Some cases of atrophic rhinitis may be so far advanced that there are very few glands left to secrete mucus, but I believe that by thorough and persistent treatment all these cases can be so far improved that all offensive odor will disappear, and the patient be relieved from all unpleasant symptoms other than those occasioned by the accumulation of mucous secretions over the parts where the mucous glands have been obliterated.

Paper.

ON CERTAIN MEASURES FOR THE RELIEF OF CONGESTIVE HEADACHES.

By WILLIAM C. GLASGOW, M. D.

ONE of the most prominent, and at times the most distressing, symptoms of congestion of the nasal chambers and sinuses is the pain and the sense of constriction of the forehead experienced

during the attack, lasting in the acute cases for a few hours; in the more chronic forms it may remain for days, or even weeks. In some cases there is a periodical return, after a longer or shorter interval, the life of the sufferer is rendered almost intolerable, and he is unfitted for any mental or physical activity. If we analyze this pain, we shall find that it is distinctly of two kinds. The one kind gives a dull, heavy sense of fullness, with occasional throbbing over the temple. The other is the sharp, lancinating pain so generally recognized as neuralgia.

At times both varieties of pain are present in the same case; in others they are entirely distinct. In the one case we recognize a fullness or local increase of the tension of the vessels; in the other a distinctly disordered nerve action. Both varieties are often due to the same pathological condition of the frontal sinuses, and the relief of the one is often followed by a cessation of the other. I do not, however, in this paper propose to consider the nasal reflexes which are now attracting so much attention, and which are distinctly neuralgic in character, but the pain and sense of constriction arising from an over-distension of the vessels.

This disturbing cause is seen in the frontal headache, browache, or so-called catarrhal headache, radiating from the root of the nose; it may be limited to the forehead; it may be felt as a dull, throbbing pain in the temples; it may give rise to intense dull ocular pain, or, extending over the head, it may be felt in the occipital region, occurring frequently from cold or exposure; we also find it often conjoined with certain vaso-motor disturbances of the mucous membrane. It is frequent at the menstrual epoch, coincident with a turgescence of the cavernous bodies, and it is the cause of many of the so-called nervous headaches, or uterine headaches, with which a similar condition of the cavernous bodies will be found. If we examine the nasal chamber during the attack of congestive headache, we shall find the cavernous bodies in a state of tension; they may not be greatly swollen or enlarged, but to the eye the condition of the mucous membrane is that of tension and fullness. The degree of tension corresponds in a measure with the severity of the headache.

A few years ago I treated these cases with hot alkaline sprays, gently applied, and the use of hot fomentations, combined with the use of the usual constitutional remedies. This mode of treatment has not been altogether satisfactory, and during the past four years I have substituted for it the local abstraction of blood, for which I

can allege unqualified success. In many cases there is experienced an immediate relief of the pain, and in all there is a sense of the loosening of the constriction. A simple bleeding may relieve the headache, or it may have to be repeated in a day, a week, or a month. I have seen but few cases which were not permanently relieved by a bleeding repeated from two to six times.

To produce the bleeding no cut is required. The cavernous body is simply pricked, and the blood flows freely until the excessive tension has been reduced; then it ceases. The amount of blood drawn rarely exceeds one ounce, in many cases it is less than this, and in some cases a single drachm of blood removed will give the requisite relief. In cases of excessive congestion the flow will equal several ounces before it ceases, the quantity of blood being dependent on the distension of the vessels, and this corresponds with the severity of the symptoms. From a normal membrane, or where there is no excessive vascular distension, scarcely a drop of blood will flow from a simple puncture of the membrane such as would produce a free flow in this pathological condition. In cases where the mucous membrane is thickened, a sharper puncture will be necessary to bring blood. A lance-headed probe may be best used in making the puncture, although a sharp-pointed bistoury, or any pointed instrument, will answer. The probe has the advantage that it does not excite the apprehension of the patients, many of whom become nervous at the sight of a knife, and dread the idea of being cut.

The following are given as types of the cases relieved by this method of treatment, and I feel assured that relief would not have been so prompt under any other mode of treatment:

Case I.—Miss M. F., a nurse, has had persistent headaches for more than a year. They would recur every few weeks, and the attack would continue several days. February, 1886, half an ounce of blood was removed, and this was repeated four times at intervals of ten days. At the last operation the flow consisted only of a few drops; since then she has been entirely free from headaches of this character.

Case II.—T. R., a merchant, has had attacks of intense frontal pain and constriction, accompanied by orbital and supraorbital neuralgia, for the past eight years. The distress was so great that he was compelled to remain in bed during the paroxysm, which would usually last four days. As a rule, the paroxysm would occur every three or four weeks. He had tried all manner of drugs and many physicians, but had obtained no permanent relief. The paroxysms occurred more frequently in winter than at the other seasons. Local depletion was practiced during the summer and autumn of 1885 on the commencement of the paroxysms; relief of

the throbbing pain and the tightness of the head was always immediate, the neuralgic pains continuing a few hours and then disappearing. During the past winter and spring he has had but one attack, and this promptly subsided after a single bleeding.

Case III.—Dr. B., a prominent and most intelligent physician of a neighboring town, has for many years been a martyr to congestive headaches and neuralgia. He has suffered so much that he is greatly broken in health and has found great difficulty in continuing his practice. His pains were frontal, with throbbing in the temples, and a dull, heavy aching pain at the occiput. These were frequently combined with severe orbital and supra-orbital neuralgia. When the attack came on he was compelled to give up his duties and to remain in bed; the paroxysm lasted for three to five days. Dr. B. was bled some ten times during the autumn and early winter. Since then he has been entirely free from his headaches and neuralgia, although he has suffered with laryngitis, and he has had a severe attack of bronchitis and rheumatism. This last illness was brought on by exposure during a long night ride in the country, and he states that it would, in former years, have certainly brought on his headache and neuralgia.

Case IV.—Miss L. E. has had, as a rule, at the menstrual epoch, a severe frontal pain with constriction. The flow is excessive and lasts usually five or six days. She called on me in January of this year, complaining of an intense headache. A local bleeding, which was repeated the next day, entirely relieved the head, and she stated the flow was less than it had been for many months. The next menstrual period passed without a headache, and she reports that they have been absent to the present date.

Case V.—Miss S. G., a sufferer with sick-headaches. A local bleeding during the paroxysm gave quicker and greater relief than had ever been attained by the use of numerous remedies which had been tried.

Case VI.—G. W., a merchant, a sufferer from hay-fever, came to my office during a paroxysm with a most intense sense of constriction of the head and a blinding headache. His face was swollen, with congested eyes and lacrymation. He presented on the whole a most perfect picture of the misery of a congestive headache and the congestive stage of hay-fever. The puncture of the cavernous body allowed the blood to gush out, and the flow continued until some three ounces had passed. Relief of constriction was immediate, the pain was greatly lessened, and the next day he was able to return to his business.

In bringing this remedy for the relief of congestive headaches before you, I may be recommending what some of you have already practiced. Now, if this should be the case, I think the practice is of such value that an additional indorsement is justifiable. Our forefathers undoubtedly made use of it, perhaps not in this manner, but

certainly they had the same idea when leeches were applied to the temples or to the nape of the neck. A somewhat similar practice was recently related to me by an old Southern planter, who told me that in the days of slavery, whenever a slave complained of a headache, he would run his penknife into the tip of his nose and the headache would be relieved.

Discussion.

Dr. Mackenzie: I am glad to see that Dr. Glasgow has observed the erection of the turbinated tissues during the menstrual period. Some time ago, in an article published in the "American Journal of the Medical Sciences" (April, 1884), I stated it as my belief that a number of the headaches occurring during the menstrual period were due to congestion of the turbinated tissues, and said that I had seen this congestion occur with great regularity. I have demonstrated in a number of patients great swelling and engorgement of the turbinated tissues during the menstrual epoch, and their gradual subsidence with the cessation of the menstrual flow. It was the practice of the ancient physicians to abstract blood from the nose in fevers, and I have read somewhere that in India they were accustomed in severe attacks of acute coryza to prick the nose. Some years ago, in a paper on "Naso-aural Catarrh," read before the Medico-chirurgical Society of Maryland (1883), I advised incision of the turbinated tissues with a sharp bistoury in the treatment of acute coryza. I stated that, according to my experience, this method gave most marked relief, and I am very glad to hear that Dr. Glasgow has had a similar experience.

Dr. Rice: The class of cases to which Dr. Glasgow has drawn attention is a very interesting one. My experience with regard to treatment is somewhat different from his, and I do not agree with him as to the pathology. I have seen a great many of these cases, as probably we all have, but they are not as a rule cases in which there is marked hypertrophy of either the anterior or posterior turbinated tissues. I have found that whatever hypertrophy did exist was over the middle turbinated bone, about three quarters of the distance back, and that it pressed against the septum. This condition is present so often that I have come to look for it in this class of cases. There has not been marked congestion or redness, but simply irritative contact, with consequent reflex pains and neuralgias. With regard to treatment, I have used the galvano-cautery instead of the knife, and I have not considered it an essential point to draw blood. My results have been good. I will cite an interesting case. A girl twenty years of age, who had suffered from most intense supra-orbital neuralgias and a sensitive condition of the nose, came to me a short time ago. For four years she had been obliged to plug her nostrils constantly with cotton so that no air could pass through them. I found nothing but an enlarged middle turbinated bone; there was no

congestion. I made four or five punctures with the galvano-cautery needle in the turbinated bone, and the woman was cured. I think it is sufficient in the majority of these cases to make marked counter-irritation over the affected part.

Dr. Harrison Allen: I can confirm Dr. Rice's opinion. While I do not at all doubt Dr. Glasgow's diagnosis, yet it is evident this is a complex subject. It seems there is abundant evidence to show that the trouble came from the turbinated tissue, but all of my cases have been of the kind Dr. Rice has described. I have found that as a rule when the septum is deflected to the left, it is at the lower part; when deflected to the right, it is at the upper part. In the place last named, contact with the middle turbinated is likely to occur. The following case illustrates several facts in this connection. The patient had a complication of disorders. She had ocular and uterine troubles, for which she had been treated by distinguished practitioners. Her headaches were of an exaggerated type. I resorted to repeated venesection of the turbinated tissues, giving temporary relief only. I then made an examination of the nostrils, introduced the finger, and separated the septum and turbinated tissues. There resulted very moderate bleeding. I found something which was very interesting. The lady was only thirty years of age, yet there was complete calcification of the triangular cartilage. The result was that her headache was completely cured. No recurrence took place. The procedure for overcoming the pressure effect may be carried out during the first stage of ether anæsthesia.

Dr. Sajous: I have not the least doubt that Dr. Allen's theory in question is well founded in many cases, but I am rather inclined to think that headaches originating in the nasal cavities are frequently due to hyperæsthesia of the nasal mucous membrane. I have had proof of that many times by the results obtained after cauterizing the mucous membrane and thus overcoming the hyperæsthesia. I think also that Dr. Glasgow's treatment rather demonstrates that fact. By depleting the cavity we reduce pressure upon the nerves, and thus lessen the hyperæsthesia. We have been told by Dr. Mackenzie that he makes a few small incisions in the nasal membrane in hay fever; certainly the cicatrices, by contracting, limit the amount of blood, and diminish hyperæsthesia. The effect of the cotton plug in Dr. Rice's case might be explained in the same way. I think that in the majority of cases hyperæsthesia is the main cause of the headache.

Dr. Bosworth: It seems to me that the correctness of the view that contact in the nose constitutes a pathological condition might be called in question. Certainly in a large proportion of cases in which I find contact between the turbinated and septal tissues I am unable to trace symptoms to that condition. There is no analogue in the human economy where mucous surfaces coming in contact with each other thereby act as centers of irritation. The mucous surfaces of the urethra, vagina, intestines, etc., come in contact with each other without

constituting pathological conditions. Some of the gentlemen speak of establishing a cicatrix in the mucous membrane of the nose. I have never seen it. The mucous membrane, when cut, heals up kindly under healthy conditions, and leaves no cicatrix. As to conditions of the nose which may cause headache, I think we can certainly say, and should go no further, that it is our duty to place the nostrils in a normal condition, to restore their healthy function. But that would open up a question which it is not necessary to enter upon here. But I think we can say that we restore healthy action in the mucous membrane of the nose, and it is not a question simply of destroying tissue or of creating a cicatrix. We do not destroy tissue with caustics. We restore healthy nutrition in the mucous membrane by reducing the amount of blood-supply, which is the object of the application of caustics, not the destruction of tissue.

Dr. Allen: I should agree with Dr. Bosworth as to restoring the normal functions of the nose, but, as I understand the normal condition, there must be no contact between the mucous surfaces, any more than there should be contact between the parts of the Eustachian tube. We all agree that contact in the Eustachian tube is abnormal. The nasal cavity is a respiratory passage as well as the seat of olfaction, and if it is a respiratory passage it must be kept open. Anything which occludes the nose destroys its function. If our conception of function is at fault, then the clinical application is wrong; but, so long as the nose is a respiratory chamber, contact is injurious to its efficiency. I should be unwilling to give this up. Argument by analogy of the behavior of the mucous surfaces in the urethra and vagina seems remote from the subject.

Dr. Glasgow: From the remarks made by several of the gentlemen I do not seem to have expressed myself clearly, since the meaning intended has not been conveyed. I do not ascribe these headaches to swelling of the cavernous bodies, but to a fullness and increased tension of the vessels of the frontal sinus, the cavernous bodies being swollen and tense at the same time The whole point is that, by taking blood from the cavernous bodies, the fullness and tension of the vessels of the sinus will be relieved.

Discussion.

THE TREATMENT OF LARYNGITIS IN PROFESSIONALS WHO ARE UNABLE TO REST.

A discussion of this subject was opened by Dr. J. Solis-Cohen, of Philadelphia, as follows: I must confess that I am not able to treat laryngitis in professionals who are unable to rest any better than I can in anybody else. When, as occasionally happens to all of us, a professional who is compelled to attend a performance that night comes to me hoarse from a recent laryngitis, caught probably *en route*, the one method which I have found the best is to administer a sharp emetic, and then let the patient rest until the time of the performance, forbidding the use

of the voice. In addition to this, I often let him keep fragments of ice in the mouth, and put a cold compress around the neck. In chronic laryngitis in persons compelled to travel and to attend to their professional duties, I have found nothing of more service than a weak solution of sulphate of zinc (two grains to the ounce), sometimes the sulphocarbolate of zinc, used two or three times a day with an ordinary hand-bulb atomizer. In the intervals of the play, if very hoarse, let them inhale a little compound tincture of benzoin. For habitual inhalation, turpentine, terebene, eucalyptol, etc., are good. Sometimes I advise these patients to throw some turpentine upon the carpet at the bed-side when they go to bed, so that they can inhale some of the vapor during the night. I am not aware of any method which is especially adapted to these people.

Dr. De Blois: I have had these professional vocalists under my care occasionally, and I have found that, no matter how much zinc is used, or how much turpentine is sprinkled upon the carpet, if they do not rest their vocal organs the hoarseness will continue. When a person has to take part in a performance within twelve hours after treatment, I have sometimes found excellent results from the local use of nitrate of silver, and very distressing results from the use of hydrochloride of cocaine. There seems to be a certain amount of relaxation following the use of cocaine, so that, although the pain of the laryngitis subsides, it does not seem to bring tone to the vocal cords. I think we may say, in general, that where there is no rest there is no cure in these cases.

Dr. Beverley Robinson: My experience in the treatment of cases similar to those referred to by Dr. Solis-Cohen has been very limited. Still I have had a certain number of cases during the past eight or ten years which I have watched pretty closely, and I have come to the following conclusions: That, as far as acute cases are concerned, there are other methods than the use of an emetic, as employed by Dr. Solis-Cohen. Certainly the persons with whom I have had to do would not consent to such treatment with any great amount of cheerfulness. In light cases I have found chloride-of-ammonium tablet triturates, taken every fifteen minutes or half-hour, the most efficient internal remedy. For local use nothing is better than the modified carbolized spray. When applied two, three, or more times a day, I think it is one of the best agents for the relief of the acute stage of laryngitis in those who are obliged to use their voice frequently. I believe the difficulty with the voice is due to the acute inflammation. So far as the chronic functional trouble of vocalists is concerned, I believe at times it is dependent upon an inflammatory condition of the mucous membrane. When I have believed this to be the case, I have used with benefit applications of an astringent solution. In such cases internal remedies are not likely to do much good. With this experience I have come to think that occasionally the trouble lay with the nervo-muscular power, and that the mere appearance of the mucous membrane was of little importance. I put it into the power of

one gentleman to re-establish his voice when it got beyond his proper control by teaching him how to use the faradaic battery once or twice a day as occasion demanded. This man's vocal cords are nearly always more or less red, but I do not attach so much importance to that, for, according to my limited experience, that condition is present to some degree in almost all vocalists, and we can not expect to bring about what is usually regarded as an absolutely normal appearance of the cords, although we may bring about vocal power.

Dr. Bosworth: As I have said before, I do not believe that there is any such disease as a laryngitis in the sense that the larynx itself is the seat of an inflammatory affection, any more than we should say there was a dermatitis when there was a thorn sticking in the flesh. The seat of the disease is not in the larynx, but in the nasal passages above. Furthermore, the treatment should be directed to the nose, the object being to contract the blood-vessels. It has become a habit with me, and I have repeated the practice successfully within a very few days in this class of cases, to eliminate the cold in the head, in the nose, by applications of cocaine. If we reduce the hyperæmia in the nasal chambers, in the majority of cases the larynx will take care of itself. My experience with the use of cocaine extends over many cases, and, contrary to what has been said by Dr. De Blois, I have not seen more than two cases in which there was any reaction. Take twelve grains of hydrochlorate of cocaine, use just sufficient water to dissolve it, and suspend it in fluid cosmoline. The patient carries with him a hand atomizer, and sprays this cocaine into the nose every hour or two. Some of it is at the same time inhaled. What is done, then, is to control the cause of the hyperæmia of the larynx—namely, the disease in the nose.

Dr. Beverley Robinson: I rise to make a correction. I think it would be a grave mistake to allow the impression to go forth that this association believes with Dr. Bosworth that a large proportion of cases of hoarseness and laryngeal difficulties depend upon nasal trouble; or that we do not repeatedly see cases of hoarseness and trouble in the larynx without any nasal trouble whatever. I think the reason why Dr. Bosworth has made this mistake is that a large proportion of the people who have laryngitis do not go directly to the specialist.

Dr. Sajous: Dr. Robinson has said in part what I had intended to say. I have treated a good many of these people, and I can most emphatically say that the action of cocaine on the larynx is pernicious. At first I supposed that cocaine was precisely the drug for these cases, so I applied a four-per-cent. solution, and sometimes a ten-per-cent. solution, to the larynx, but every time I used cocaine I had occasion to regret it. These people felt afterward as if some foreign body were in the throat which rendered them unable to use it properly. As to acute laryngitis in singers, I do not see the necessity for always attributing it to a nasal trouble. In the majority of these cases there is fatigue as a cause. They generally owe it to their heartless manager, who requires

them to rehearse six or seven hours a day, besides performing at night. The presence of a cold in the head, of course, occasionally militates against our treatment, a fact which we must not overlook when these patients come for treatment. I never neglect the nose in these cases, but I can not agree with Dr. Bosworth that in every case the nose is affected. It has been my custom to use internal treatment to a degree. I have found quinine and nux vomica of great assistance in some cases in which local applications to the larynx were not beneficial. I have found even sprays irritating; fumes are sometimes so. I content myself then with giving a grain or two grains of quinine every hour or two hours, with a quarter of a grain of nux vomica. In that way I am very often able to place patients in such a state that they are able to sing in the evening. A weak faradaic current, as recommended by Dr. Robinson, I have also found advantageous. I make the application at my office, and request the patient to come for another application an hour before the performance. Now, with regard to coca wine, I can not say that I disregard its merits at all. I generally advise patients to take between the acts a sherry wineglassful, and have always obtained satisfactory results with it. Formerly this kind of laryngitis had been to me a kind of bugbear, but within the last year, since recognizing the virtues of these remedies, I have obtained better results.

Dr. Glasgow: I object decidedly to the views advanced by Dr. Bosworth. I have cured laryngitis without touching the nose, and I regret that such heretical opinions should have been presented. I have seen the class of patients who are the subject of discussion at present. The laryngitis from which they suffer is of various kinds. When they are obliged to play, I do not spray the nose and I do not use cocaine. I use an application to the larynx consisting of carbolized iodine, which is a soothing application, one which relieves the congestion; and it gives power, for it is also a stimulant. Thus a great many of these people are enabled to finish their engagement, not cured, of course, but relieved. I have seen many such patients, but my attention has been given to the larynx, and not to the nose.

Dr. Rice: It seems to me that the whole truth is not on either side in this discussion. I think the predisposition to laryngeal congestion and inflammation does usually originate in the nose. I believe that nasal troubles antedate laryngeal troubles, and predispose to the laryngeal congestions and consequent disorders of the voice from which singers suffer. On the other hand, these people are frequently unable to sing on account of fatigue of the laryngeal muscles, when there is no disturbance in the nasal chambers at all. I agree with Dr. Robinson that the color of the mucous membrane in the larynx in these cases is of little significance. I have seen one or two singers who could sing exceedingly well whose vocal bands were always red. On the other hand, persons who have constant difficulty with the voice sometimes have pallor of the mucous membrane, and no other pathological condition except inac-

tion of the internal muscles of the larynx. With regard to treatment, I think well of Dr. Bosworth's prescription of cosmoline and cocaine, but I think it is the cosmoline which does the work, not the cocaine. I approve of cosmoline and vaseline prescriptions. I have had much better results with a spray of vaseline in the larynx, or some mild soothing application of that kind, than with astringents.

Dr. Asch: The views presented as to laryngitis being due invariably to nasal disease must be received as individual, and not as representing the generally accepted opinion. By no means a few still believe that affections of the larynx belong to the larynx alone. I believe that the cases under discussion should be divided into two classes: those which are acute, and those which are chronic in character. The acute cases, I have found, are best treated by ordinary methods for treating any acute complication. A singer can not be relieved any more quickly than anybody else. But by vapors, internal medicines, etc., I think we can resolve this condition as readily as any other. The internal treatment which I have employed is like Dr. Robinson's. I think chloride of ammonium is one of the most useful internal remedies in diseases of the larynx or bronchi. The difficulty in treating singers is the fact that they are unable to take rest. There is a certain amount of hyperæmia constantly present in their vocal organs, together with some thickening of the membrane, which will not be cured without local applications. I do not think that applications to the nose will cure it. I have seen a number of cases in which there was no catarrh of the nasal passages; the whole trouble seemed to be in the larynx. Nothing equals the application of an astringent, but I do not believe it necessary to use any exclusive method. The spray does well in some cases, but if I want to cure a case I use the brush. The application which I have most frequently used is a solution of perchloride of iron, thirty to sixty grains. In many cases, when singers get rather hoarse, a single application of this kind will put them in very good condition. It will not cure them, but it will enable them to sing or to speak. There is another matter which has been overlooked. Many singers, especially opera-singers, lead rather an irregular life; they take a good deal of wine, eat heartily when they are not expected to sing, and are apt to suffer from some hepatic trouble. I do not believe that there is any method by which the larynx of the professional singer can be put in perfect order while he is at work.

Dr. Hooper: I would say a word with regard to a class of cases not yet referred to—namely, those of professionals in whom there is an alteration in the quality of the voice simply from overexertion or fatigue. In one case of this nature I have seen a want of tension in one cord and not in the other. Applications of electricity externally over the larynx, and the use of aromatic spirit of ammonia, thirty or forty drops in half a tumblerful of soda-water, repeated, are very efficacious in these cases.

Dr. J. N. Mackenzie: I think Dr. Bosworth has been a little unjustly criticised in this discussion. For my own part I think he is to a

great extent right in his conclusions as to the dependence of laryngeal upon nasal diseases. I think that the vast majority of cases of chronic laryngitis will be found on careful examination to be dependent upon or associated with disease of the nasal passages, and upon the recognition of this fact, it seems to me, depends the successful treatment of the vast majority of cases of chronic laryngitis which we see in practice. Yet I admit there are cases in which the larynx is the primary seat of the disease, and that apart from any local irritative process. I should like also to caution against the indiscriminate and injudicious use of cocaine in diseases of the nose and throat. I have called attention to this at several meetings of this association. The explanation of the danger which suggested itself to me was that after a while the cocaine produced a permanent puffy condition of the erectile tissues. I am confident that in several cases I have prolonged the condition several weeks by the use of cocaine, and I shall never use it just before the singer is going on the stage or the speaker commences to address an audience. The sensation in the larynx which these people experience after the use of cocaine is sometimes second only to that of hanging. I have tried it on myself. But when it is used in the nose the sensation is delicious, provided none of it trickles down the throat. I think the impression is gaining ground in this country that the indiscriminate use of cocaine is to be deprecated.

Dr. Westbrook: I think the suggestions of Dr. Solis-Cohen and of Dr. Asch have not received sufficient consideration. While it is undoubtedly true that many singers and elocutionists who suffer from acute and chronic laryngitis suffer from strain and overwork of the vocal apparatus, yet it is probably true that in the majority of the cases the primary cause of the trouble is some derangement of digestion. It is this, probably, which predisposes them to these laryngeal affections. There are a great many singers and readers who do not have laryngitis, and there is a minority who do. It is fair to conclude that in the latter class there is a predisposition to it, and I think this predisposition depends primarily upon malassimilation—the lithæmic, gouty, or rheumatic condition. Therefore the practice of giving an emetic is very valuable, and the advice of Dr. Asch, which is in the same direction, is almost equally important. I think there is nothing so beneficial in cases of this kind as to give a large dose of tartar emetic. Calomel and jalap are very good, also podophyllin, compound cathartic pills, and so on; but it seems to me that an active emetic does more toward restoring the natural condition than all these other things. I think I have seen a number of cases of acute hoarseness clear up very rapidly under the use of mineral acids. The best way to give them is in very small doses frequently repeated, say every hour or half-hour. I have seen cases in which it was necessary to give the salicylates or wine of colchicum.

Dr. Langmaid: Although so many remedies have been found to be sure cures, I doubt if any of the gentlemen have found the condition in question an easy thing to cure at all times.

Paper.

A CASE OF LEUCOPLAKIA BUCCALIS. RECOVERY.

By W. C. GLASGOW, M. D.

AT the Detroit meeting of the society in 1885 our esteemed president, Dr. Ingals, read an exhaustive paper on "Leucoplakia Buccalis," and reported a case which had recovered under the local use of the galvano-cautery. It has been my fortune to have a similar case in which recovery has taken place under a less heroic method of treatment, and I take this opportunity to place it on record:

Mr. F., a merchant, forty-eight years old, consulted me on January 15, 1885, on account of a trouble of the throat. He stated that for some weeks he had had pain and difficulty in swallowing, and a certain amount of thickness of speech. He had been losing flesh and weight, with an increasing degree of weakness and loss of mental activity.

On examination, the right tonsil appeared swollen and very red, the left slightly enlarged. On each anterior pillar of the palate an opaline patch was seen covering the greater part of the pillar. There was also a small patch of similar character on the lower part of the tonsil. The removal of a portion of the patch left a bleeding surface. About the middle of the tongue was a thickened opaline patch, of nearly the size of a quarter of a dollar, with several fissures extending to the tip of the tongue; a small opaline patch was also seen on the side of the tongue. On the left side of the tongue was a small, irregular-shaped ulcer, with clear-cut edges, looking as if it had been cut out with a punch, and extending through the mucous membrane to the submucous tissue. Certain of the appearances in the throat, more especially the deep, clear-cut ulcer, gave rise to the suspicion of syphilis, but, on questioning him, no definite syphilitic history could be obtained. He stated that, about twenty-five years before, he had had a slight sore which was cauterized; from his description, this was probably a herpes præputialis. This healed immediately, and since then, until his throat began to give him trouble, he had enjoyed perfect health. There was no enlargement of the glands, and he had absolutely no history of a secondary symptom. He was married and had four children. His wife and children had always been perfectly healthy. He was a great smoker, using daily from ten to twelve cigars.

In spite of this history, I determined to give him specific treatment. I ordered him full doses of the biniodide of mercury and made daily applications to the throat with the carbolated iodine, and ordered him to give up his cigars. Under this treatment he steadily grew worse; the patches continued to enlarge, until the whole tonsil was covered with a

yellowish-white patch. The soft palate and uvula became swollen and œdematous.

The specific treatment was then discontinued and he was given a simple iron tonic, and the local application of the iodine was continued.

He continued under this treatment for three months with the most gratifying result. The patch on the tongue disappeared, the ulcer healed, and the patches on the tonsil were scarcely visible.

The soft palate and uvula remained greatly swollen and œdematous. The mucous membrane was hanging in folds and ridges, as if partly detached from the submucous tissue. A slight cutaneous eruption appeared in the form of isolated flat tubercles on the end of the nose, with a few on the face, and a few patches of squamous eruption were seen on the back of the neck. I am inclined to believe the tubercles to be the result of iodism. His health had greatly improved, and he was able to swallow without pain.

On May 1st I sent Mr. F. to the Hot Springs, Ark. Here the physicians he consulted regarded his case as syphilitic, and gave him the regular treatment. He was thoroughly boiled and bathed, and received heroic doses of mercury in the form of blue ointment, with enormous doses of iodide of potassium. After a two-months' course of this treatment, finding that he had been steadily growing worse, he consulted another physician. This gentleman, after a study of the case, doubted the syphilitic origin, and was inclined to consider it epitheliomatous. When I saw Mr. F. again, on July 1st, a very decided aggravation of his disease was apparent. He had again lost flesh, he was weaker, and his throat pained him greatly on swallowing. The soft palate and uvula were œdematous, and on the soft palate could be seen three crescentic-shaped patches of about the size of a threepence; each patch consisted of a number of small papules, and it was surrounded by a well-defined red band; there were similar patches on the right tonsil. The pillars of the palate still showed the opaline color.

I now gave him liq. potass. arsenitis in full doses, and continued this for ten days; all local treatment was discontinued. At the end of this time the patches of papules had disappeared, and the place was covered by a white-yellowish exudation.

He now received tonic doses of mercury and potash, $\frac{1}{96}$ gr. of the former and 1 gr. of the latter. Under this treatment he steadily improved, and in six weeks his throat had regained its normal appearance, with the exception of a small opaline patch on the side of the tongue, enlarged tonsils, and a fullness of the uvula. He could swallow without pain, and he had gained in weight and strength. At this time he visited Europe and spent a month traveling through the British Isles. He considered himself entirely well, having regained his strength, and his throat gave him no trouble until he caught a cold at the Isle of Wight. He then hastened to London and consulted Dr. Morell Mackenzie. Our distinguished colleague, after hearing his history and examining him, gave him

the opinion that his throat disease was syphilitic, and prescribed for him minute doses of the iodide of potassium. Mr. F. returned home in perfect health, and from that day to this has not had a sick day. His throat is perfectly normal, with the exception of slightly enlarged tonsils.

In a throat practice of seventeen years I have seen many syphilitic throats, but have never seen one resembling this case. I have seen mucous patches and condylomata and the papillary syphilides in all varieties; in all these cases the condition has yielded to constitutional treatment. From my experience with this case, I can not agree with our distinguished colleague in considering it to be a case of syphilis. This opinion I form from the following facts:

1. There is no history of syphilis; the initial lesion is very problematical and no secondary symptoms have appeared in twenty-five years.

2. Aggravation instead of improvement of the local disease under the most heroic and persistent anti-syphilitic treatment.

3. Improvement and recovery under a simple tonic treatment, such as we should expect to be of benefit in any simple chronic inflammatory condition.

4. A healthy family showing no sign of the syphilitic dyscrasia.

I should rather consider the throat disease to be the result of excessive smoking, and the history and results of the case seem to perfectly justify the conclusion.

Second Day—Afternoon Session.

Paper.

GLANDULAR AND CONNECTIVE-TISSUE HYPERTROPHIES OF THE LATERAL WALLS OF THE PHARYNX.

By CLARENCE C. RICE, M. D.

PATHOLOGICAL conditions of this portion of the upper respiratory tract, the lateral walls of the pharynx, have not attracted much attention, and the little that is to be said here in regard to such lesions is stated as much because of its pathological interest as of its clinical importance. Clinically, we are not in the habit of separating by any characteristic symptoms inflammatory

processes of the sides of the pharynx from coincident conditions occurring about the pillars of the palate and the tonsils. If it be an acute inflammation, the symptoms of painful deglutition, heat, and general discomfort about the back of the mouth, are satisfactorily accounted for by evidences of tonsilar or palatal inflammation, and the sides of the pharynx are not critically examined. If the process is a chronic one, the symptoms of a general naso-pharyngeal catarrh are explained by manifest pathological conditions in the nasal cavities and "post-nasal pharynx," which, by the way, is a far better term for this part than the "vault of the pharynx" or the "post-nasal space." And, again, whatever abnormal conditions may be noticed upon the sides of the pharynx, they are not considered especially significant as forming any very considerable part of the pathology of upper respiratory catarrhal inflammation.

From a therapeutic standpoint we must recognize lesions that commonly appear on the lateral walls of the pharynx, for they demand correction at the hands of the operator during the treatment of a naso-pharyngeal catarrh as much as pathological conditions higher up in the upper pharynx or nose. Luschka and Meyer, of Copenhagen, did valuable work in studying and describing the glandular structure of the vault of the pharynx, and later investigators have done much toward making clear the pathology of post-nasal catarrh by demonstrating the similarity in structure of the glandular tissue at the vault of the pharynx with that of the faucial tonsils. That this identity is true beyond all peradventure can be easily proved by microscopical examination. I have had a number of specimens taken from the pharyngeal and from the faucial tonsils examined by expert microscopists, and it has been shown that in children the two structures are almost precisely the same. In adults the faucial tonsils, on account of their exposed position and the consequent frequent inflammatory attacks to which they are subjected, take on hyperplastic changes, and an abundant connective-tissue stroma is found here which does not show itself in the adenoid layer at the vault. It is of more than histological interest that these structures, the one in the upper and the other in the lower pharynx, have been found to be alike, for not only is it conclusive proof of the intimate anatomical relation between the parts, but it is found that they are affected frequently at the same time by the same inflammatory process, thus demonstrating the close relation between glandular inflammations of the post-nasal pharynx and of the oro-pharynx. This is a very important point clinically, because it places

diseases of the middle pharynx where they properly belong—in the general class of catarrhal inflammations of the respiratory and not of the alimentary tract.

I have noticed several times a pathological condition which I dare say is familiar to you all, but one which I am surprised to find is rarely described in text-books or mentioned in general medical literature, and that is a complete tissue connection, by reason of hypertrophy, between the enlarged faucial and pharyngeal tonsils. The former have gradually extended upward and the latter downward from the vault, until they have met. I am not speaking now of those raised folds formed of combined connective tissue and glandular hypertrophy which are frequently to be seen running up and down parallel with the posterior pharyngeal pillar. I believe that the oral and the pharyngeal tonsils become continuous in this manner: first the faucial tonsil develops backward, and so grows into, and passes behind, the posterior pillar. The simple follicular glands, of which anatomists tell us there is a linear grouping at this location, that is, on the side of the pharynx, have also undergone a hypertrophic change, and have pushed themselves upward from the surface until they have met the faucial tonsil, and together they have formed a comb-like spur or excrescence, and have extended upward at the same level as the tonsil, until, in one mass, they have disappeared behind the soft palate, where they can be traced into the substance of Luschka's tonsil. If this is the manner in which the follicular structure at the sides of the pharynx takes part in general glandular enlargement above and below, it not only adds additional strong proof of the identity of the tissue of the first, second, and third tonsils, but it apparently demonstrates that these so-called tonsils are, after all, only a globular collection of the same simple follicles which have a linear arrangement up and down the lateral walls of the pharynx, and that these simple lateral follicles are merged into the hypertrophied faucial and pharyngeal tonsils without any line of demarkation to indicate change of tissue structure.

We should say, then, that chronic follicular pharyngitis of the lateral walls of the pharynx is the commencement of this pathological process, and that it may and sometimes does progress until this follicular and hyperplastic enlargement forms the connecting link between the true upper and lower tonsils. This is the first form of the glandular hypertrophy which is referred to in the title of this paper, a pathological condition which I do not find described fully

anywhere, but alluded to in "von Ziemssen" by Wendt,* who speaks of the "combs of the tonsil" extending downward from the vault; but he does not describe the filling in of the gap between the upper and lower tonsils by this glandular enlargement of the lateral walls of the pharynx.

Other writers say that adenoid hypertrophy of the vault sometimes extends almost down to the soft palate, and I mention Sajous as one.†

This process, then, seems to be nothing more than an unusual degree of that pathological condition which we usually find in children who are suffering from chronic catarrhal inflammation of the nose and pharynx, an excessive glandular development, and a hypertrophy of the mucous follicles of the side of the pharynx, together with faucial and pharyngeal tonsilar enlargement. I have not noticed this condition in very young children, but in young adults from twelve to eighteen years of age, and, I presume, for the reason that it requires this number of years for the lateral glandular tissue to reach this very unusual degree of hypertrophy. The entire line of glandular tissue, including the pharyngeal tonsils above and the faucial tonsils below, seems to be nourished by the same blood-supply, for it has been my experience that, as soon as any portion of the chain was destroyed by knife or cautery, there was a strong tendency to atrophy on the part of the remaining glandular structure, and that, too, without surgical interference. I have seen the entire mass on the lateral wall of the pharynx disappear in a month after the tonsils above and below had been removed.

We now come to a second very interesting pathological condition of the lateral walls of the pharynx—a condition which is described by Schmidt‡ under the name of "pharyngitis lateralis," and one which he regards as a localization of "pharyngitis granulosa," or, as it should more properly be called, "chronic follicular pharyngitis." Schmidt quotes Störk# as the sole author (Billroth, "Handbuch d. Chirurg.," vol. iii, pt. 1, 1880) who has appreciated the fact that this modification of pharyngitis folliculosa at times occasions much discomfort in consequence of hyperæsthesia of the corresponding part. We find that Störk describes the pathological condition of pharyngitis lateralis, but only as a modification of general chronic follicular

* Wendt, "von Ziemssen," vol. vii, p. 39.

† Sajous, "Diseases of the Nose and Throat," p. 231.

‡ Schmidt, "Deut. Archiv für klin. Med.," 1880, vol. xxviii, p. 421.

Störk, "Klinik der Krankheiten des Rachens," 1876, p. 114.

pharyngitis, and he adds that these lateral hypertrophies are sometimes the seat of extreme hyperæsthesia, driving physician and patient to despair.

Michel* says, in the case of patients laboring under pharyngeal difficulties, and who had been judged hypochondriacs because of the apparently normal condition of the post-pharyngeal wall that he found circumscribed inflammatory thickening of the lateral walls of the pharynx.

Minute anatomical descriptions of the lateral walls of the pharynx have been given by Luschka,† and later by Zaufal,‡ who state that this region may be the seat of pathological conditions; but these authors do not, as does Schmidt, lay great stress upon the fact that this localization of a follicular pharyngitis oftentimes explains distressing symptoms the cause of which is not easily apparent.

The most satisfactory description of so-called "lateral pharyngitis" we find given by Schech# in his text-book. This latter author, with Zaufal, states that the fold called the "plica salpingo-pharyngea" is the particular portion of the lateral wall of the pharynx which is involved in "pharyngitis lateralis." This salpingo-pharyngeal fold commences at the posterior end of the cartilaginous orifice of the Eustachian tube, and extends downward parallel to the lateral wall of the naso-pharynx and the posterior pharyngeal pillar. When hypertrophied, it can be traced downward as far as the attachment of the palato-pharyngeus muscle, or it becomes lost in normal mucous membrane at the level of the tip of the epiglottis.

The pathological change indicative of localized inflammation of the lateral pharyngeal walls we have all seen, and we are familiar with the symptomatology of this condition. There are two inflammatory processes which may occur here which perhaps it is best not to confound; the one is the acute inflammation of the simple follicles of the pharyngeal wall, just behind the posterior pillar, occurring with or following a disease of precisely the same nature—acute follicular tonsillitis, the characteristic white-mouthed follicles appearing primarily, sometimes on the tonsil and sometimes on the side of the pharynx. They also disappear together, and a narrow superficial red line of raised tissue, running up the side of the pharynx, is all that

* Michel, "Zur Behandlung der Krankheiten d. Mund-Rachenhöle und des Kehlkopfes," Leipsic, 1880.

† Luschka, "Der Schlundkopf des Menschen," pp. 16 and 33.

‡ Zaufal, "Die Plica Salpingo-pharyngea," "Archiv f. Ohrenheilkunde," vol. xv, p. 97.

Schech, "Diseases of the Mouth," etc., p. 114.

remains to mark the location of frequent attacks of acute follicular inflammation.

The second pathological process is a localized hyperplastic inflammation of the mucous and submucous structures at this point, or, according to Schmidt and Schech, a hyperplastic enlargement of the salpingo-pharyngeal fold. The pathological change usually commences in the simple follicles of this region, as a result of frequent attacks of follicular inflammation of a mild grade, aggravated, as Dr. Harrison Allen suggests, by the constant physiological activity of these parts. Chronic congestion and consequent hyperplastic infiltration soon follow, and eventually the enlarged follicles are encroached upon and their integrity destroyed by the surrounding connective tissue. The two processes can not clinically be separated, and the raised adventitious fold or ridge on the side of the pharynx is composed of both glandular and connective-tissue elements. The elevation of the mucous membrane may be unilateral or bilateral; if found on both sides, they are rarely symmetrical. They are sometimes broad and thin, and at other times as thick as a lead-pencil. Sometimes they are so large as to prevent the approximation of the soft palate with the posterior pharyngeal wall. And Schech explains the symptom of pain in many of these cases by the fact that this hypertrophied pharyngeal band, which passes over the superior constrictor muscle, is, by the contraction of this muscle, wedged between it and the posterior surface of the soft palate, thus exciting the sensitive and irritable pharyngeal nerves. These bands are easily overlooked, situated as they are behind the posterior pillars, and are only brought prominently into view by contraction of these pillars. They may be hardly distinguishable from the palato-pharyngeus muscle, or sharply separated from it. The color of this fold is generally redder than that of the surrounding mucous membrane, but it may be normal; on the whole it presents an innocent appearance, and yet it is frequently the sole lesion to be found, which may account for a train of constant and disagreeable symptoms. That it should be recognized and classified as an important pathological change in catarrhal pharyngitis is proved by the fact that with its destruction the unpleasant symptoms of the patient frequently disappear. In what cases do we find evidence of "pharyngitis lateralis"? Slight pathological changes in this direction are seen in many, perhaps the majority, of cases of post-nasal pharyngitis, but in my experience the disease is particularly peculiar to a certain class of patients, thin, pale, nervous men and women, more

frequently the latter; people who are always thinking and talking of their throats, who suffer from sore throats almost every day. This soreness, they explain, is a feeling of burning and rawness rather than of pain. The discomfort is present in the morning, disappears after breakfast, and returns during the afternoon. Fatigue of the voice during speaking and singing is another prominent symptom. The sufferer is extremely apprehensive in regard to the condition of his throat, and believes that he is the victim of cancer or consumption. Examination of the pharynx and larynx shows but little. A pale mucous membrane, with but little submucous tissue, drawn tightly over the prominences of the cervical vertebræ, a few enlarged follicles scattered over the pharyngeal wall, and a number of prominent veins, are the changes which first meet the eye, but none of these adequately explain the severity of the patient's symptoms. During a paroxysm of gagging, however, the thickened lateral wall of the pharynx is brought prominently into view, and on touching it firmly with a probe, a sensitiveness is noticed which is not elicited by pressure on other parts. A coughing paroxysm, spasm of the glottis, and a husky voice are the temporary results produced by this stimulus.

That this pharyngeal band is the pathological condition which produces the rawness, pain, and fatigue of voice, it is fair to conclude, since these symptoms are usually relieved or disappear altogether when this ridge is destroyed by caustics or the cautery.

I believe that it is a mistake to consider the middle pharynx so much a part of the alimentary tract as only to be affected by and together with stomachic trouble. Glandular hypertrophies in children and connective-tissue infiltration in adults are characteristic lesions in the oro-pharynx of a chronic catarrhal pharyngitis, similar in character to and directly dependent upon nasal and post-nasal catarrhal inflammations.

And the two lesions I have called your attention to in this paper, first, the direct connection of the upper and lower tonsils through the medium of enlarged mucous follicles of the lateral walls of the pharynx, and, second, the hypertrophied lateral pharyngeal bands composed of glandular and connective-tissue elements, these two lesions demonstrate that the upper and middle pharynx are two portions of the same tract, attacked by the same inflammatory processes by reason of the same causes, and they are not materially unlike by reason of any difference in anatomical structure or physiological function.

Paper.

THE GALVANO-CAUTERY IN THE TREATMENT OF HYPERTROPHIED TONSILS.

By CHARLES H. KNIGHT, M. D.

WE have been told by one authority that in the normal condition the tonsils do not exist, or at least are not visible,* while another observer has recently asserted that these organs perform an important function in eliminating from the saliva certain ingredients which would otherwise be wasted.† The special office of the portion of secretion thus absorbed is supposed to be to provide nutrition for the leucocytes formed in the tonsils. The old idea of the function of these bodies seems to have been that they furnished a lubricating secretion to facilitate the act of swallowing, as possibly suggested by the curious definition given in Motherby's "Medical Dictionary," published in 1795, which reads as follows: "They are of a reddish color, and externally have many holes, which communicate with an irregular cavity in their inside, and which contains a viscid fluid, which is gradually discharged from the holes into the throat." Whether we accept this view, or adopt the theory that they are in some way concerned in hæmatosis, or invest them with both these functions, the fact is evident that in many individuals the tonsils undergo enlargement to such a degree as to impair health, if not to endanger life, since in their hypertrophied condition they show a constant propensity to inflammation, which may assume a serious aspect. A fatal case of enlarged tonsils has been reported by Dr. C. A. Blair,‡ death resulting apparently from asphyxia. A case, reported by Shaw, is referred to by Lefferts,# in which tracheotomy was actually performed in order to save the life of the patient. A similar case has been reported by Puech. ‖

The picture of a typical example of hypertrophied tonsils is a familiar one. If a child, the victim of this condition has the appearance of feeble health, the face is pale, the teeth are closely crowded

* F. H. Bosworth, "Trans. of the N. Y. Academy of Medicine," vol. iv, 1886, p. 298.

† R. Hingston Fox, "Jour. of Anat. and Physiol.," July, 1886, p. 559.

‡ "Med. and Surg. Reporter," Philadelphia, 1880, xlii.

"Med. Record," New York, 1879, xvi, 601.

‖ "Moniteur des hôp.," 1857.

in the narrow jaws, the mouth is small and is generally kept open, the lips are thick, the lower one often projecting and inverted, these conditions being due in part to defective development, and in part to the habit acquired of drawing the lower jaw forward in order to drag the tonsils away from the opening of the glottis. The nose is pinched, the nostrils are small and narrow. The voice is thick and lacks resonance. The child is apt to wear a heavy, stupid expression. Finally, the so-called "pigeon-breast" deformity results from the extraordinary labor demanded of the respiratory muscles. And yet we sometimes hear the advice given to let a child outgrow this condition. Undoubtedly, atrophy will in most cases occur after puberty, if the subject survives to that period, but meantime development is retarded, and robust health is utterly impossible. No doubt, too, when the hypertrophy of the tonsil is dependent upon a constitutional taint, much relief may be obtained from general medication, hygiene, generous diet, etc.

The question of the relation between hypertrophied tonsils and the constitution of the patient has been much debated. In his "System of Human Anatomy,"* Dr. Harrison Allen observes that "it is rational to assume that overgrowth of the tonsils is an attempt at compensation on the part of an organ engaged in manufacturing blood-corpuscles, when other blood-making structures, such as the medulla of bone, are inactive." Treves, in his work on "Scrofula,"† says that one of the most common manifestations of scrofula is the enlarged tonsil. On the other hand, Bosworth‡ asserts that "it is the result of a purely local morbid process, not the outcropping of a constitutional dyscrasia. Impairment of health, if present, is a result, not a cause." Probably in many instances it would be more correct to say that impairment of health is *both* a cause and a result. In either case prompt recovery, or even marked amelioration, is not likely to ensue from any system of drug-giving or local applications. Very often improvement in the general condition is accompanied by decrease of local tumefaction, but the true hypertrophied tonsil never entirely disappears until maturity. From a critical review of the subject of amygdalotomy, by Felix Semon,# it appears that a process of atrophy is to be expected in not more than three fourths of the cases. In the mean time, nasal voice, defective articulation, mouth-

* Section vi, p. 640.

† F. Treves, "Scrofula and its Gland Diseases," 1882, p. 110.

‡ "Trans. of the N. Y. Acad. of Med.," vol. iv, 1886, p. 305.

"St. Thomas's Hosp. Rep.," vol. xiii, 129.

breathing and snoring respiration, facial disfigurement and thoracic deformity, impaired audition, not from encroachment of the enlarged gland upon the Eustachian orifice, but from thickening of the mucous membrane of the tube, imperfect mastication, dyspepsia, and declining general health, comprise a train of symptoms which render the existence of the patient a burden to himself and to others. The extraordinary statement occurs in Billroth's "Surgical Pathology" * that hypertrophied tonsils are commonly a sequel rather than a cause of pharyngeal inflammation, and hence relief of the latter can not be expected to follow their extirpation. Quite the contrary opinion is generally held. Disturbed cerebral circulation as a result of pressure from the enlarged glands has been suggested by Chassaignac,† and the same observer has called attention to disorders of digestion due not only to impeded deglutition, but also to the conveyance of putrid secretions from the tonsils to the stomach. Mackenzie‡ notices that the senses of smell and taste become defective if the condition of hypertrophy be allowed to persist for a long time. In view of all these possible evils, the question of surgical interference must be considered.

The surgical treatment of enlarged tonsils has been a subject of no little discussion. The large number of amygdalotomes devised by various operators bears witness to the favor with which a cutting operation is regarded, while the supposed danger of hæmorrhage altogether deters not a few surgeons from the use of the knife. The question of hæmorrhage after amygdalotomy was the subject of an able paper presented to this association in 1881 by Dr. Lefferts.# The conclusions then reached were that fatal hæmorrhage was rare, that dangerous hæmorrhage occasionally occurred, that serious hæmorrhage, immediate or remote, was not unusual, while moderate bleeding, to a degree requiring pressure or the use of strong astringents, was common. In the course of the discussion following, Dr. Allen stated that he had discarded the bistoury and amygdalotome for fear of hæmorrhage, and was inclined to prefer the galvanocautery. On the other hand, Elsberg announced that he had operated more than eleven thousand times, generally by cutting, and had met with but two cases of alarming hæmorrhage. In my own experience only two cases of serious bleeding have occurred, one in a child,

* Transl. of 4th German ed., N. Y., 1872, p. 611.

† "Leçons sur l'hypertrophie des amygdales," Paris, 1857, p. 7.

‡ "Diseases of the Nose and Throat," vol. i, p. 65.

"Trans. of the Am. Laryngol. Assoc." 1881, p. 136.

which came on on the fifth day after a very radical amygdalotomy, and ceased spontaneously; the other in an adult, the hæmorrhage being finally checked by continuous pressure. A somewhat careful review of the literature of the subject shows that a large majority of cases in which this accident has happened were those of adults, and that in most of them it followed the use of the bistoury. According to Mackenzie, four cases have been reported by Velpeau in which the internal carotid artery was laid open during removal of a tonsil with the bistoury. Billroth * seems to have wounded the ascending pharyngeal artery while operating with a bistoury. Other cases are on record of hæmorrhage from a large tonsilar artery, from injury to one of the faucial pillars, and from wounding the venous plexus at the lower border of the tonsil. It seems to me, however, that this risk of the operation in children has been overestimated. Yet it must be admitted that the danger of hæmorrhage is the chief objection to excision of the tonsils.

Probably few of us use the amygdalotome without the suggestion of its possibility. Among arguments in opposition to removal of the tonsils in general, which are sometimes urged, may be mentioned the statement that the voice is thereby weakened and the sexual function impaired. Observations to the contrary are now too numerous to leave any room for question on these points. There has been a superstition that enlarged tonsils are a protection against infective disease, but it is now pretty generally agreed that they are a direct encouragement to infection, especially diphtheritic, while the subject of this hypertrophy is constantly liable to attacks of amygdalitis and peri-amygdalitis, extremely painful and often disabling. It is hardly probable that "suicidal mania," as a result of amygdalotomy, will be used as an objection to the operation by those who present an adverse plea, but it may be of interest to notice incidentally that four cases of suicide after amygdalotomy have been reported by Rubio.† In addition to hæmorrhage, which, if not serious, may be very troublesome and a source of agitation to the patient, it is not uncommon to meet with other obstacles to a cutting operation. We frequently see broad, flat tonsils, deeply seated between the pillars, the anterior pillar often overlapping the gland and being firmly adherent to it. The use of the guillotine here is difficult, if not impossible. Finally, in some cases the patient's aversion to the knife can not be overcome.

* J. Walker Downie, "Edinb. Med. Jour.," August, 1886, p. 116.

† R. B. Taylor, "On Amygdalotomy and Suicide," "Med. Times and Gaz.," ii, 1881, p. 758.

Under such circumstances the galvano-cautery, said to have been introduced into surgery by Middeldorpf, offers a satisfactory alternative. Two methods of its application to the treatment of enlarged tonsils have been found useful—by cautery-puncture, as practiced by Voltolini, and by the galvano-caustic snare. In the former method a fine cautery-point is passed deeply into a crypt of the enlarged gland, if we have to deal with a condition of simple hypertrophy, or in the case of a hyperplastic tonsil, where the crypts are more or less obliterated, it may be forced directly into the substance of the tonsil. Not more than three independent lacunæ should be cauterized at one sitting. The pain of the operation is usually not severe, and inflammatory reaction is seldom excessive. By the fourth or fifth day all local disturbance will have subsided, the eschar may be partially detached, and the operation may be repeated. In this way the largest tonsils may be destroyed in from five to ten sittings, according to the tolerance of the patient. At the International Laryngological Congress, held in Milan in 1880, Krishaber stated that he had been obliged to use the thermo-cautery of Paquelin in one case no less than fourteen times.* Such an experience with the galvano-cautery would be very exceptional. Still he maintained that patients submitted to burning more readily than to cutting. In one of my cases, that of a boy not ten years old and of highly nervous temperament, the use of the galvano-cautery had to be abandoned after the second operation, not, as the patient admitted, on account of pain, but because he could not overcome his repugnance to the idea of being burned. In this case treatment has been continued by means of applications of London paste, and the patient himself states that it causes greater and more lasting pain than the galvano-cautery did. Many patients complain of the disagreeable odor of the burning tissues more than of pain. The discomforts of the operation and of the succeeding days may be reduced to a minimum by preliminary applications of cocaine in ten-per-cent. solution, and the subsequent use of carbolized alkaline gargles and, if necessary, further applications of cocaine.

Galvano-caustic écrasement is much more rapid and naturally more painful than cautery-puncture. A single operation by the former accomplishes the results of many weeks by the latter. Moreover, the amount of tissue actually removed by the snare does not represent the total effect of the operation, since the parts left behind are cauterized to a considerable depth. The galvano-caustic snare is

* "Trans. of the Int. Laryngol. Congr.," Milan, 1880.

opposed by some writers, among them Schech,* who maintains that its use involves too much trouble, that it is difficult to secure an even cut surface, and that it does not exclude the danger of hæmorrhage. The first objection may perhaps be admitted; the second and third are groundless. A single case of hæmorrhage after the use of the galvano-caustic snare has been reported by Capart.† The bleeding, which was rather alarming, occurred in a child, eight years of age, five days after the operation, and was undoubtedly provoked by immoderate use of the voice.

Two precautions are essential. The current should be employed intermittingly, and traction should be made upon the loop only during the passage of the current. In this way hæmorrhage may be entirely avoided, and the danger of damaging the pillars of the fauces and neighboring parts by diffusion of heat may be prevented. Should any unevenness of surface remain, it is a very simple matter to remove it by subsequent cauterizations. Inclusion of the greater part of the tonsil within the loop may sometimes be effected by dragging it from its bed by means of a volsella or a mouse-toothed forceps, or by the use of a transfixion needle. In several cases pain has been almost wholly abolished by injecting into the parenchyma of the tonsil, before applying the snare, six or eight minims of a ten-per-cent. solution of cocaine. At best this method is rather disagreeable, and is apt to be followed by considerable local disturbance. Its only advantage over galvano-puncture is that of being less tedious. The choice of a battery is of some importance. What is known as the "C & C" Electric Motor Battery has given me excellent satisfaction. For the snare, No. 30 platinum wire has been found to be more readily heated, more easily manipulated, and to cut the tissues with greater facility.

The use of the galvano-cautery in very young children will probably often be found impracticable, except under general anæsthesia. Only two of my own subjects were under the age of ten years, and one of these was unmanageable. It is not my intention, therefore, to recommend the galvano-cautery as a universal substitute for excision of the tonsils. In the vast majority of cases a cutting operation is both possible and preferable. Galvano-cautery should be reserved for a comparatively small proportion of cases, including those in which the hæmorrhagic diathesis is present or suspected, those in

* "Diseases of the Mouth, Throat, and Nose." Transl. by R. H. Blaikie, 1886, p. 130.

† "Trans. du congrès internat. de laryngologie," Milan, Sept., 1881, p. 96.

which vascular anomalies may be recognized, those in which anatomical conditions prevent a sufficiently complete excision of the organ, and those in which the use of a knife is positively declined. I am strongly disposed to add that this method should be chosen for all adult patients. At any rate, as Semon has suggested, a patient above the age of twenty should be allowed his option after a fair presentation of the risks and advantages of the two methods.

Discussion.

Dr. C. E. Sajous: I have frequently tried the method advocated by Dr. Knight, puncturing the tonsil repeatedly with the galvano-cautery, and I am inclined to think that, unless one is rather heroic in the treatment, it will prove too tedious. As to operating on the tonsil with the galvano-cautery snare, I think it is an excellent method. The plan I usually pursue is to tighten the wire around the tonsil first and then apply the current. The heated wire burns as long as it is tightly drawn around the tonsil. By drawing it up more, the entire gland is gradually burned through. In operating in that way I have never yet seen the patient lose a drop of blood. The procedure requires from twelve to fifteen minutes, and is rather unpleasant to the patient, but it is safe. As to hæmorrhage after amygdalotomy, I have had two cases which were exceedingly tedious and very dangerous. One of the cases occurred recently in a patient sent me by Dr. Bartholow. He had large tonsils, the vessels were large, he was of a plethoric habit, and was forty-seven years of age. I hesitated to use the guillotine, and by using the galvano-cautery puncture succeeded in bringing the tonsils down pretty well, but not with sufficient speed to satisfy the patient, who said that Dr. Bartholow also thought it might be done more rapidly. I concluded to take off a part of the tonsil with the guillotine, but found that my apprehensions regarding hæmorrhage had not been ill-founded, for, after I had taken a piece off, the patient had seven consecutive hæmorrhages, losing several ounces of blood.

Dr. T. R. French: It not infrequently happens that patients will refuse the guillotine and submit to applications of the cautery. In cases where the tonsils are small or have been insufficiently removed, and can not be grasped by the guillotine, the cautery is a very valuable substitute. I should like to inquire if Dr. Knight usually finds it necessary to use cocaine before applying the cautery loop to the tonsils. I am in the habit of using the cautery quite freely in these cases, and have not seen inflammatory reaction, except in one instance, and then it was very mild. I certainly do not consider the danger from hæmorrhage after the use of cutting instruments sufficiently great to make the cautery method preferable to amputation with the guillotine.

Dr. A. W. MacCoy: I have had some experience with the galvano-cautery, and am in the habit of making a distinction in its application

to different conditions. In cases of glandular hypertrophy I am fond of using the galvano-cautery, but for some years past I have ceased to use it in the interstitial, or connective-tissue, hypertrophy. I think the objection which has been raised is probably founded somewhat on the truth, that in cases of interstitial hypertrophy it is likely to leave a cicatrix which often constitutes a painful and annoying point or the basis of further trouble. I do not use the snare, and am not satisfied that the point is more satisfactory than several other caustic measures, especially chromic acid. Applying this agent on a small probe inserted into the crypts, I am satisfied that one can get quicker action and less disagreeable and offensive sloughing than in some cases in which the galvano-cautery is used. I am positive that I have seen a few cases in which the cicatrix in the tonsil made by the galvano-cautery was the source of great annoyance.

Dr. Beverley Robinson: I have pretty distinct views on this subject. For my part, I have held, and hold more firmly to-day than ever before, that there is no so-called small operation in surgery that is so unpleasant to perform as amygdalotomy. Mothers bring their children to the doctor for an operation upon enlarged tonsils, supposing that it is a comparatively trivial affair, but, for my part, I prefer not to do it if I can avoid it. I think this feeling is due partly to a certain kind of timidity; I do not believe that there is any great probability of serious hæmorrhage. Still, the operation is one which I regard as an unpleasant one. Eight or nine months ago a child was brought to my office with very large tonsils, almost touching each other in the median line. I felt a good deal of timidity about cutting them off, and had my friend Dr. Bull see the patient, who said that of course they ought to be excised. Dr. Bull was present at the operation, and Dr. Hasbrouck administered nitrous-oxide gas. The teeth of the child remained tightly clenched and were separated with difficulty, thus rendering the operation less easy. Despite this fact, and likewise that one tonsil could not be completely excised with the amygdalotome, the operation was completed; the child bled a good deal, but not alarmingly. Still, for a few minutes it was to me, as it often has been, a disagreeable experience, and I do not hesitate to say that I would rather perform tracheotomy than amygdalotomy in a small child. I do not believe the tonsils are taken off with half the frequency that is generally believed, even by men who are not bad surgeons. I have used the galvano-cautery several times, and I am inclined to regard it as one of the most convenient and best methods.

Dr. C. C. Rice: It seems to me most unfortunate to unduly frighten the profession with regard to the dangers of tonsil-cutting. I do not propose to speak of the frequency of hæmorrhage, but we all know that it occurs very rarely. The large, white, boggy, hypertrophied tonsils of children must be cut. There is no substitute for the amygdalotome here, as the use of the galvano-cautery is a slow, tedious process. The child will bear only one touch of the cautery at a time. I am not

underestimating the value of the galvano-cautery in adults, for it is a very efficient instrument in reducing tonsils. I think we must generally resort to amygdalotomy in children. The galvano-cautery is particularly useful in adults when there is reason to fear hæmorrhage, and in cases in which the tonsil is so small that it is difficult to grasp it with the guillotine.

The PRESIDENT: I do not mean to occupy much time in speaking on this subject, although it is one of considerable interest to me. I think it was Dr. Solis-Cohen who, a number of years ago, said something about treating the tonsils with the galvano-cautery. I have done this frequently, but my experience has been different from that of some of the gentlemen who say there is no soreness afterward. At least that is the impression I have of their belief. In the cases in which I have used the galvano-autery, whether used little or much, there has always been soreness. The patient complains of it for from one to three days. If it is possible to reduce the size of the tonsil with any sort of rapidity and without this soreness I should be very glad to know it, but from my experience I can not believe that it is possible. In the paper to which I referred I believe it is stated that twenty or thirty operations were required. I have latterly come to feel very much like one of the speakers regarding removal of the tonsil in children, but not for quite the same reason. I do not think I am timid about it, and I do not fear hæmorrhage, but I hate to hurt these little ones. I think it is as serious a matter for a child to have the tonsils removed as it would be for an adult to be hung, so far as the mental suffering is concerned. If this can be avoided it certainly ought to be done. On this account I have been in the habit for some time whenever it was practicable, and it usually is, to give ether, and remove the tonsil with the snare, using a large steel wire; and a tonsil forceps when the gland is not easily secured by the wire loop.

Dr. HARRISON ALLEN: Hearing the paper and the discussion has awakened my memory to the circumstance of Dr. Lefferts, when president, reading a valuable paper upon tonsilar hæmorrhage. He took for his motto, "To be forewarned is to be forearmed." In fact, when you take out a tonsil you must be ready for hæmorrhage. Dr. Lefferts advocated amygdalotomy, yet his homily was, "Be ready for hæmorrhage." If I remember aright, I was the only one in the hall at that time who opposed amygdalotomy. I did not hesitate to express dread of such operations. You do not know what vessel will be wounded. I think we should take particular care in the selection of our cases, and not make too broad a statement in favor of amygdalotomy. We should not forget that the general practitioner may not be able to select cases with as much judgment as Dr. Rice, who advocates free cutting. The cases of serious hæmorrhage are much more numerous than we know of.

Dr. D. BRYSON DELAVAN: I have operated many times. I have occasionally seen the operation followed by pretty sharp hæmorrhage, but I believe that, with suitable means at hand for checking it, there is little danger. I prefer the Physick amygdalotome as modified by

Morell Mackenzie, and have never known its use to be attended with undue loss of blood. General practitioners often become much alarmed at the first gush of blood which follows the excision. That gush is perhaps the rule, but it generally ceases within a few minutes. If it does not subside we have means of stopping it. I have found it very difficult to discover many authenticated cases of dangerous hæmorrhage after amygdalotomy. I have been very much interested in the paper read by Dr. Knight, and have used the method referred to in a number of cases with decided success. I think, however, that in children it is very difficult of application, but that it is especially applicable to persons whose tonsils are of large size, and who are old enough to control themselves.

Dr. J. Solis-Cohen: I can only say what I said before this association several years ago, namely, that in many cases of moderate engorgement on freeing the palate from the tonsil the tonsil will go down without further operation. Inflammation causes adhesion of the tonsil to the anterior fold of the palate. The tonsil being fastened there, it can not go down. I think that, in a great many of the cases of hæmorrhage, at any rate of minor hæmorrhage, the bleeding is caused by cutting the arch of the palate. The vessels here run vertically, and, of course, if you cut out an oval portion they can not contract as they do when the vessel is cut transversely. With regard to the galvano-cautery, while I have used it a good deal, I have never been able to obtain the success with it which the writer of the paper alleges. I should like to send him a number of patients to see whether they could be relieved by four or five applications. In my own cases it has required twenty, thirty, or even fifty applications of the galvano-cautery, whether used in the interior of the tonsil or on the outside. A very good method is to take a flat-bladed knife, such as is used with the electro-cautery, penetrate the tonsil transversely, and work your way outward. This may require one, two, or four days. Then go in the vertical direction, and thus get a half or a third of the mass off. Repeat with the remainder, gradually trimming the irregularities of the tonsil down as you proceed. In that way, if the patient is able to keep up his visits regularly and long enough, I am able after some time to get permanent good results.

Dr. C. H. Knight: I think Dr. Solis-Cohen misunderstood me when he represented me as saying that it required only four or five applications of the cautery to cure the tonsils. I said the tonsil should be burned at two or three points, and that it took from four to ten sittings, the average being from six to eight. With regard to cocaine, I do not use it habitually; I do not think the tonsil is a very sensitive organ, but, for the sake of reassuring the patient, I sometimes use cocaine.

Paper.

NOTE ON A FREQUENT CAUSE OF NASAL HÆMORRHAGE.

By BEVERLEY ROBINSON, M. D.

EVERY general practitioner and every specialist meets with cases of epistaxis. Some of these are insignificant so far as prognosis is concerned. They may cause temporary annoyance to the individual, but frequently, when the bleeding is stopped, the patient suffers no ill effects from the loss of blood. Indeed, I have occasionally known young or plethoric persons to have headache relieved by free, spontaneous bleeding from the nose, and to feel more buoyant subsequent to its occurrence.

In general practice, as a sequela of fevers—notably of typhoid, measles, diphtheria—in chronic cardiac affections of different types, in Bright's disease of the kidneys, and in some other diseases that I could mention, profuse nasal hæmorrhage may occur, and at times is serious on account of its weakening effect and its difficulty of arrest.

Such, however, are not the cases of abundant epistaxis that, as specialists, we are likely to encounter. In the majority of instances in which patients consult me, either at my office or at my throat clinic, as to the cause and treatment of recurrent epistaxis, a more or less advanced stage of atrophic rhinitis is evident.

Usually the disease is known to have existed during several years when I am called upon to treat it, and attacks of epistaxis have become so frequent or so profuse as to occasion considerable anxiety. When the history of these patients is carefully taken, it is found that at first the nose-bleed was not very abundant or often repeated, and was easily arrested. Then, when ordinary household remedies failed to check it, the family physician was called in and different treatment was employed. An examination of the nose with suitable light and instruments was then occasionally * made, and, when finished, nasal catarrh was stated to exist. Thereupon the nasal douche, or the repeated employment of some medicated powder or salve, was ordered. This treatment usually proves unsuccessful, and after pursuing it for some time the patient finally consults a specialist.

Sometimes the attack of epistaxis is suddenly and alarmingly profuse, either in the beginning or at a later stage of the disease causing it, and plugging the nose is resorted to in the hope of arresting

* Often only the most imperfect examination (or none at all) is attempted.

it. One or two posterior plugs are introduced behind the soft palate by means of Bellocq's cannula or an ordinary catheter, carrying a small cord, to which the lint or sponge is attached.

Frequently the nasal fossæ are filled anteriorly with one of these substances, previously immersed in subsulphate of iron. Anterior plugging in the manner described often allows continuous and even abundant oozing alongside the nasal plug.

Posterior and anterior plugging at the same time almost always stop bleeding for the while, but when the plugs are withdrawn after twenty-four to forty-eight hours, it may or may not begin afresh. Examination of these cases after the plugs are removed and the nose thoroughly cleansed usually reveals the probable cause of nasal hæmorrhage in the existence of an erosion of the mucous membrane covering the cartilaginous nasal septum. The loss of tissue is variable as regards extent and depth. Sometimes it is small and superficial. Occasionally it involves a considerable area, or has penetrated the cartilage itself. Under these circumstances ulceration seems a more applicable term for the condition presented than erosion. If bleeding has occurred shortly before the patient is seen, and no covering has been formed by the introduction of some foreign substance of styptic nature, the erosion is bare and exposed, with the exception, perhaps, of a small amount of inspissated blood-clot which partially conceals it. If, however, bleeding has not occurred for several days, and in many instances when a particular point of the eroded surface occasions the hæmorrhage, the larger portion of the erosion is covered with an adherent crust which, if forcibly detached, occasions an immediate recurrence of epistaxis. Now and then I have seen the eroded surface as a mere point in extent, and yet the resultant hæmorrhages have been very considerable. This is true whenever the eroded point is seated directly over an arterial twig upon the septum, and by its corroding action has perforated into and through the arterial wall. The site of this perforation is usually about three quarters of an inch behind the nares, very near the junction of the cartilaginous and bony septum, and at a quarter to one third of an inch above the floor of the nasal fossæ. On one occasion I have had an opportunity to treat a case of profuse epistaxis occurring in a young lady in whom there was no erosion of surface at all, and no local cause whatever of recurrent hæmorrhage from the nose, except the extreme thinness of the pituitary membrane and the abnormal tenuity of the vascular walls. In this case it was presumable for a time that the epistaxes were *vicarious*, and, as later events proved,

they were so, at least in part. But that they were not wholly so was proved by their continuance after menstruation, owing to the operative procedure on the uterus, had become tolerably normal. There was nothing in the general condition of the patient satisfactorily to account for the recurrent nasal hæmorrhages, and finally I was obliged to consider them as entirely due to atrophy of the nasal mucous membrane. As a general means for arresting these hæmorrhages when they occur, and also for the purpose of modifying in a continuous manner the vascular supply of the diseased nasal membrane, I now rely upon the internal use of a combination of fluid extract of ergot, with tincture of digitalis. The preparations of these two drugs made use of by me are two to four parts of the former to one part of the latter, and of this mixture I give ten to twenty drops every few hours during several days when I wish to prevent the return of epistaxis; every ten to fifteen minutes, or in one or two large doses immediately, during the continuance of nasal hæmorrhage. I have also had evident good results from antipyrine in capsules, in doses of five, ten, or fifteen grains. Locally, to arrest nasal hæmorrhage, I rely somewhat upon hot water, which, however, often fails me, and principally upon plugging anteriorly one or both nasal passages with strips of sheet-spunk.*

When packed thoroughly in the nose, this substance forms an almost insurmountable barrier to nasal hæmorrhage, and it is only in very rare instances that we shall be called upon to introduce a posterior nasal plug.

In order to perform this operation with the least difficulty, I know of no instrument, particularly in children, quite equal to Steele's pliable probe. It is more serviceable than any ordinary catheter, or than Bosworth's or Bellocq's cannula. It is small enough to go through almost any nasal passage, no matter how impervious; it is sufficiently resistant to take and preserve the curve best adapted to the size and conformation of the parts alongside which it passes. In regard to curative local treatment the following plan has proved, in my experience, most successful: 1. Abandonment of every kind of douche or spray, as a rule, to loosen adherent crusts, if they are present. 2.

* Spunk is the product of a species of a genus of mushrooms denominated *Boletus*. It is known by botanists as the *Boletus igniarius*, or agaric of the oak, and usually rests immediately upon the bark of the tree. It was formerly much used by surgeons for arresting hæmorrhage, and probably acts mechanically. It is in flat pieces, of a consistence somewhat like that of very soft buckskin leather, and of a brownish-yellow color ("U. S. Dispensatory," thirteenth ed., pp. 1524, 1525).

Reliance for this purpose on the topical use of different kinds of ointments, which, in the course of a few days, soften and imbibe the crusts to that degree that they become readily detached by a moderate effort of blowing the nose. The ointment I favor the use of most in the beginning of treatment is the white precipitate ointment made with vaseline of full or half the pharmacopœia strength.* This ointment is applied three times daily, either with a camel's-hair brush or simply with the index-finger, and then sniffed into the nasal passages sufficiently to cover over the entire diseased surface.

After the crusts are removed, I make occasional applications of strong solutions of sulphate of copper, nitrate of silver, or (preferably) of compound tincture of iodine, to the seat of the erosion. Usually the very simple treatment advised, when persisted in, will bring about a complete cure in one or two months of the erosion and of the epistaxis. The original disease, as we all know, is one of the most obstinate which, as specialists, we are called to treat. I trust the apparent triviality of my subject will not hide its real interest and importance. To make this fact manifest, I would merely add that until I adopted the treatment outlined in the foregoing remarks I was frequently baffled in my successful care of patients thus affected, although I followed closely the indications ordinarily insisted upon by writers on atrophic rhinitis. Particularly would I refer in this connection to the injurious effects of the galvanocautery, which I have known to render a slight affection lasting and very troublesome, by producing raw surfaces very difficult to heal in the subjects of this special form of nasal disease.

In conclusion, I desire to say that, although the subject of my brief remarks is mentioned here and there in laryngological literature in a casual way, Dr. G. M. Lefferts is the only person, so far as I know, who has attempted to give an accurate and complete description of it. To this I refer my hearers in the Philadelphia "Medical News," vol. xl, 1882, p. 100.

* This is forty grains to the ounce.

Third Day—Morning Session.

Paper.

AFFECTIONS OF THE CRICO-ARYTENOID ARTICULATION.

By GEORGE W. MAJOR, M.D.

THE crico-arytenoid articulation, from a mechanical point of view, is a gliding surface which allows of rather than regulates movements. Friction between the cartilages is prevented by the interposition of a bursa mucosa instead of a synovial bursa, as in other joints. It is subject to much the same diseases as joints elsewhere, and, in my experience, is liable to be relatively affected more frequently. In fact, in my investigations, I have found that the crico-arytenoid articulation is prone to take on unhealthy action from comparatively trifling causes.

For several years my attention has been directed to abnormal states of this joint, and has resulted in the gradual accumulation of an amount of clinical material, the publication of a part of which may possibly prove of some practical value.

It does not come within the scope of the present paper to consider at any length affections of the joint arising from constitutional states, such as tuberculosis or syphilis.

In laryngeal phthisis the arytenoid region is frequently the first invaded, and even in favorable cases it is seldom that some impairment of movement does not result. In phthisis, vocal defect is usually attributed to myopathic causes or to tumefaction of the soft parts, whereby the vocal cords are either not properly tensed or poorly approximated. Independently of the destructive changes which the cartilage may undergo in phthisis, I am disposed to think that the altered state of the articular surfaces (the result of prolonged inflammation) plays a not altogether unimportant part. Tubercular deposits undoubtedly take place, and, if absorbed, must leave behind a quantity of calcareous material especially liable to impair articular integrity.

Syphilis frequently, especially when advanced, affects the crico-arytenoid joint and produces a true ankylosis.

The principal affections of the crico-arytenoid articulation to which I shall allude are sprain, dislocation, direct local injury, acute inflammation, and ankylosis.

Sprain may result from the sudden closure of the larynx when, in the act of swallowing, any solid or liquid has passed, or threatens to pass, into the laryngeal area. This accident may occur when there is lowered sensibility, as, for example, in the morning on rising. The throat of a person who breathes through the mouth is always dry on awaking, and the sensibility consequently diminished. In such an individual it is not difficult to understand how a combination of circumstances may give rise to sprain.

The action of the larynx is reflex, and, under the conditions alluded to, the muscular movement is sudden and spasmodic.

An unusual strain is thrown upon the muscles and a sprain is the result.

Case I.—Mrs. A., aged forty-five, consulted me on April 22, 1887, for dysphagia. She is a strong and healthy woman and has not suffered from rheumatism or any constitutional disease. On external examination, digital pressure revealed tenderness over the left arytenoid region. A laryngeal examination showed some redness of the joint and slight swelling. The approximation of the vocal cords is perfect and the voice is not impaired. There is extensive hypertrophic rhinitis, and nasal respiration is proportionately impeded. Six weeks before visiting me, she arose in the morning and took a drink of milk, some of which "went astray." She felt a sudden pain in the region indicated, and has since suffered more or less pain and difficulty in swallowing. She breathes through her mouth at night, and as a consequence finds her throat dry in the morning.

Applications over the arytenoid region of liquor epispasticus and the use of laryngeal sprays of astringent character have reduced the swelling, redness, and sensitiveness of the joint, and swallowing has improved *pari passu*.

Dislocation of the arytenoid cartilage is of extremely rare occurrence. Several instances are reported of dislocations the result of cicatricial contractions, but I am not aware of any as the result of direct violence.

Case II.—M. G., aged forty, came under observation on June 25, 1883. She complained of inability to swallow solids, and for two months subsisted on milk, milk and soda-water, and the yolk of an egg beaten up with milk. She is of an extremely nervous and fretful disposition, and at first I was inclined to regard her case as of an hysterical nature, and in fact was so indiscreet as to so express myself, to her intense disgust.

She gave the following history: Two months previously her son, a big, strong boy, while indulging in horse-play, undertook to demonstrate an improved method of garroting. He seized her larynx between the thumb and fingers of the right hand, and, not realizing his strength, produced

such local injuries as led to the conditions presently to be described. The pain at the moment was severe and continued for some days unabated. Swallowing was difficult, and gradually aggravated. On external examination, tenderness was evinced over the right arytenoid region, the situation occupied by the young gentleman's thumb. There was glandular swelling and pain extending to the right ear, and stiffness of the muscles of the right jaw. The right side of the neck was sufficiently swollen, making all due allowance for excess of development of the right side, to attract attention. With the laryngoscope the right arytenoid was seen to be swollen, and its apex was inclined outward and backward. There was swelling of the pharyngeal wall on the right side. On laryngeal movement, the following points were observed: On full inspiration the right arytenoid cartilage was free from contact with the pharyngeal wall, though the sinus pyriformis was smaller than on the left side. On attempting phonation, the apex of the arytenoid came in contact with the pharynx, and in moving toward the median line it not only produced a well-marked line of depression on the pharynx, but its point was also bent outward. When nearing the center point of phonation the arytenoid was released suddenly, with a decided and audible clicking sound. There was a perceptible hesitation in the process of phonation, allowing ample opportunity to observe the movement. The different conformation of the sides was apparent.

The voice was unimpaired, though speaking or reading was both fatiguing and painful.

The patient was under my care for four months, during which time gradual improvement occurred.

In this case there certainly was swelling of the pharynx, but there was also displacement of the arytenoid cartilage. As the cords approached in phonation, the cartilage gradually recovered its proper position.

The partial dislocation at one situation and total disappearance at another is not altogether inexplicable if we consider the character of the crico-arytenoid joint and its muscular attachments.

Displacement was probably the result of pressure exerted on the cricoid cartilage, whereby its diameter was somewhat altered.

The treatment consisted in the use of soothing inhalations, hot fomentations, and iodide of potassium. When some improvement had been achieved, laryngeal sprays were employed, as also the liniment of iodide of potassium with soap. The stiffness of the muscles, especially those of the jaw, was treated by a skilled masseuse with success.

Case III.—W. G., aged fifty, five years ago struck his neck against a clothes-line in the dark. Disease of the cricoid cartilage resulted, and im-

pending suffocation demanded tracheotomy. I assisted a medical friend in the performance of it. The tube is still worn, as occasional inflammatory attacks of the larynx render the precaution necessary.

The left crico-arytenoid joint is dislocated backward and is fixed at a point midway between extreme abduction and the cadaveric position. The vocal cord, which is occasionally visible, is quite motionless on attempted phonation or full inspiration. A rough but useful voice is produced by the right vocal cord, assisted by the ventricular band of the left or impaired side. The left ventricular band may be seen to dispose itself as follows: On attempted phonation, though its anterior and posterior points of attachment do not advance, its free margin is thrown inward, forming a convex belly which meets the vocal cord of the healthy side.

This manner of forming voice is not usual in the case of a ventricular band, though of comparatively frequent occurrence in the compensating action of a vocal cord. A healthy vocal cord may often be observed to protrude itself beyond the median line to meet its fellow, the freedom of whose movements is from some cause or other interfered with. The case serves as an example of dislocation the result of cicatricial adhesions.

Injury of the crico-arytenoid joint the result of traumatism must be comparatively common, though, from the undecided character of the symptoms, it no doubt often escapes detection.

Case IV.—Miss G. came under my care on October 23, 1886, complaining of difficult deglutition. She was liable to sudden attacks of suffocation caused by the entrance of food into the larynx. Two years previously, while swallowing an oyster, a portion of shell stuck in the throat. The pain at the time was intense and lasted some days, during which the speaking voice was impaired and swallowing of anything but bland liquids was rendered impossible. The treatment adopted at the time was sedative inhalations. After a week or more the piece of shell was expectorated with some blood after a violent fit of coughing. The throat did not recover completely, and the continuous dread of a recurrence of suffocative paroxysms interfered with her appetite and digestion.

On digital examination, tenderness over the crico-arytenoid region was found to exist, and this was notably increased on pressure. With the laryngoscope the left arytenoid was seen to be larger than the right and somewhat redder. On phonation, the joint did not rotate properly nor glide toward the center. There was a decided comparative difference in the movements of the two joints. Local applications of a twenty-per-cent. solution of lactic acid applied daily gave relief, and a permanent cure after two months' treatment.

Acute inflammation of the crico-arytenoid joint is met with in rheumatic and gouty attacks, in tonsilitis (a disease of rheumatic

origin), in measles, scarlet fever, croup, bronchitis, and in many other acute diseases where the air-passage is involved.

It but seldom attains sufficient prominence to call for the attention of an expert, and consequently is not so often recorded as its frequency of occurrence would suggest.

Case V.—In October, 1886, I was consulted by a professor in the medical faculty of McGill University for dysphonia. On examination, I found the left arytenoid slightly swollen and red. At a line corresponding to the contact of the articular surfaces the color was very much intensified. The joint was fixed at full inspiration, and on attempted phonation, inward movement was barely perceptible. There was also external tenderness over the crico-arytenoid region. Rheumatic inflammation of the crico-arytenoid joint was diagnosticated. Further inquiry developed the fact that a week before he had suffered from an attack of acute inflammation of the right wrist and elbow joints.

Case VI.—On the 16th of March last I made a laryngoscopic examination of Master Frederic D., aged two years. I had seen the child on a former occasion at the request of Professor Ross, of McGill University, but did not make an examination, as the child was suffering from an extensive abscess of the neck, and I decided to postpone any attempt until evacuation had taken place.

During an attack of measles of more than usual severity complete aphonia resulted without the slightest embarrassment of respiration. The aphonia developed many days before there were any signs of inflammation of the tissues of the neck.

On laryngoscopic examination, I found the left arytenoid fixed at full inspiration and completely immovable. There was redness about the joint and external tenderness. The larynx was otherwise free from any abnormal appearances.

Case VII.—On April 19, 1887, I was called to see Miss H. It appears that until two days previously she enjoyed her usual good health. After dining she was suddenly seized with suffocative paroxysms. The family physician was summoned, and among other means employed expectorants. Slight improvement followed, for at the time of my visit I found on examination marked swelling and œdema of the left arytenoid joint, and the joint was completely fixed near the median line. I ordered a blister externally and steam inhalations. In the course of two days the œdema had entirely disappeared, leaving the joint red, swollen, and still immovable. Chloride of zinc, used as a laryngeal spray, and the continued use of blisters, produced gradual improvement.

This case was one of acute inflammation of the joint, the result of cold. Beyond the local lesion described, the larynx presented no abnormal conditions. Tenderness still persists on external pressure.

Ankylosis is the affection of the crico-arytenoid joint most commonly met with, and may arise from a great variety of causes. Among

the causes may be enumerated chondritis or perichondritis, primary or by extension, syphilis, typhoid fever, rheumatism, gout, the exanthems, and catarrhal conditions of the air-passages due to any cause. In my experience the most common cause of ankylosis is rheumatic or catarrhal inflammation of the joint.

I have met with one case only as a sequence of typhoid fever, in which necrosis of the cricoid had occurred, and have seen it many times as the result of syphilis.

Every possible degree of ankylosis may exist, from barely perceptible impairment of movement to absolute immobility. The size of the joint may also vary from extreme hypertrophy to actual wasting. The influence an ankylosis is capable of exerting in a given case depends upon the degree of ankylosis, the size of the ankylosed joint, and the situation on the cricoid at which ankylosis has taken place.

Of these three features the most important is of course the point at which ankylosis has been accomplished, as it regulates the all-important functions of respiration and phonation, and the symptoms of ankylosis depend much upon this latter condition. The leading symptoms of ankylosis may be laid down as follows:

If the joint is fixed at full expiration or phonation, the leading feature is embarrassed breathing, and inspiration is interfered with proportionately as the fixation takes place toward the above position. There is here little if any interference with voice production. Swallowing is, as a rule, not difficult, yet there may be a feeling as of the presence of a foreign body. Fortunately, ankylosis does not often take place inward, and this is no doubt obviated by the position assumed by the joint during the greater part of the time. There is usually some enlargement of the joint, but there may be actual wasting. Externally there is usually tenderness felt on pressure. On manipulation, there is generally a sensation conveyed to the fingers as of a decided roughness of the articular surfaces, and not uncommonly a distinct sound is detected, which may be either a distinct friction rub or more of an articular gliding character.

When the joint is fixed more at full inspiration, or midway between full inspiration and expiration, the latter naturally the more usual situation, phonation is interfered with, and not inspiration. Leakage of air, however, takes place here, and the patient easily gets out of breath on any violent exercise or exertion; this is of course aggravated as the ankylosis approaches extreme abduction.

Difficulty of swallowing is also here more pronounced, and the

danger of foreign bodies entering the larynx is greater. Tenderness is felt on pressure externally, and on manipulation the characteristic friction-sound is obtained.

Ankylosis at full adduction or abduction seldom occurs, the majority of cases being between the two extremes, and both joints are seldom affected.

It not infrequently happens that the ankylosed joint is smaller than its fellow of the opposite side.

This comparative difference is not necessarily the result of wasting of the tissues about the impaired articulation, but often is due to an hypertrophy of the healthy joint caused by an excess of activity in its work of compensation. This hypertrophy of the joint of the healthy side does not happen if the ankylosed joint is fixed at or near the median line, as then the effort to produce voice is not great, and the amount of work thrown upon the healthy side is proportionately small.

Atrophy of an ankylosed joint may occur as the outcome of want of use, just as happens elsewhere in the body.

The symptoms just now described, especially those relating to respiration and phonation, closely resemble symptoms of paralysis and require to be distinguished.

The differentiation between ankylosis and paralysis is by no means easy, though, generally speaking, quite possible, and is, moreover, a practical point of some importance.

The diagnosis has no important bearing in so far as the present state of the patient is concerned; for what can it matter whether a joint is fixed at any particular point by ankylosis or by paralysis of the muscles?

The prognosis and treatment are certainly very much influenced by the decision of this question.

The history of the case must be considered and all advantage taken of extraneous information. Tenderness on pressure over the crico-arytenoid region, possibly some enlargement of the joint capable of being felt externally, swelling or enlargement as seen by the laryngoscope, the sensation and sound on manipulation—will all assist the diagnosis of ankylosis. The absence of these signs will favor paralysis.

In paralysis we have generally characteristic shapes of the glottis. The general appearance, conformation, and behavior of the larynx when under examination will assist a diagnosis.

Last but not least, difficult deglutition is characteristic of many

cases of marked ankylosis; in fact, in all cases of difficult deglutition ankylosis should be looked for.

The treatment of ankylosis is simple, and if persevered with for a sufficient length of time is not unsatisfactory. Frictions of a dilute ointment of biniodide of mercury over the crico-arytenoid region; the local use of astringents or of a weak application of iodine in glycerin; iodide of potassium internally, and galvanism—are all worthy of trial.

Massage, when properly carried out, will also be found useful.

Paper.

CANCER OF THE LARYNX.

By H. A. JOHNSON, M. D.

PREVIOUS to the invention of the laryngoscope, cancer of the larynx was recognized only after death or in the last stages of the disease. The reason for this seems to be found in the fact that, as a rule, the development of the disease in other organs or in neighboring glands either does not occur, or occurs only as one of the later manifestations.

The two cases observed by Morgagni were diagnosticated only at the post-mortem. The case of Louis (1837) seems to have been under observation for a long time, but the cancerous nature was only determined at the autopsy. This case was thought by Louis to be the first one of cancer of the larynx reported. The report was incomplete, as were also those of cases noted by Trousseau, Bricheteau, Bauchet, Bart, and others. Krishaber states that the first complete description and report of a case of cancer of the larynx seem to have been published by Gibb in 1864. The paucity of the early literature upon the subject, and the comparatively few cases that up to the present time have been recorded, is the only justification I have to offer for the brief and in many respects unsatisfactory notes of the following cases:

Case I.—X., aged sixty-five, male, of good habits. No specific taint. In fair health till one year before consultation, when he began to have some trouble with the throat. Soon afterward he noticed that he had pain in swallowing. The secretion of saliva was excessive and annoying. Early in the fall there began to be dyspnœa and dysphonia, and finally complete aphonia, and for this I was asked by his physician to see him.

I found the epiglottis and vestibule of the larynx the seat of a somewhat firm growth, the larger part of the mass on the left of the median line. No enlargements of the lymphatics. The growth had so far encroached upon the glottis as to produce constant difficulty of breathing. After a few unsuccessful attempts to reduce the tumor and relieve the dyspnœa by topical measures, I was called in great haste one night and found the dyspnœa so alarming that I at once performed tracheotomy. This gave him complete relief, and he was for some time able to be up. Deglutition, however, was difficult and painful. Death occurred about three months after the operation.

So far as I could learn, there was nothing to suggest a cause for the trouble, and no hereditary taint. From the fact that the initial symptoms were connected with the act of swallowing and that the respiratory functions were modified subsequently, in connection with the excessive mucous secretion, I infer that its origin was extrinsic or mixed, and that in its progress the internal surfaces of the larynx became involved. No post-mortem was made, but, as the tissue was quite firm and as there was no marked hæmorrhagic tendency, I think it was an epithelioma.

Case II.—X., aged seventy, male. Antecedents good; no cancer in family. Now in feeble health. Dysphagia and marked dyspnœa. I was asked by his physician to see him with reference to the propriety of the operation of tracheotomy. The vestibule of the larynx was filled with a ragged, irregular mass, with only a narrow, tortuous opening, through which a limited amount of air could pass. It seemed to be attached to or to involve more of the left side than the right. There were no manifestations of disease elsewhere. He had suffered much for a long time, and when the question of an operation was suggested to him he quietly asked how long life could be prolonged; and when we said several months he replied: "I hardly feel able to live so long. If it is not wrong, I want to die soon." He declined the operation and died a few days afterward during a paroxysm of dyspnœa. No post-mortem was made.

I have but little doubt as to the origin. It was intrinsic, and probably from the left side above the vocal cord. There had been no hæmorrhages.

Case III.—K., male, aged sixty-eight. Merchant; no cancer in family. Always in good health till within a year of the time of consultation, when he began to have some irritation of the throat, slight difficulty in swallowing, with cough; soon afterward the voice became hoarse, and when I was asked to see him he was completely aphonic. Examination revealed a somewhat smooth but slightly lobulated mass, springing evidently from the right internal wall above the vocal cords. I could not determine its

point of origin more definitely. There was some glottic stenosis, but, as the dyspnœa was not great, efforts were made to reduce the growth by the galvano-cautery. Quite large masses were in this way destroyed, but the reproduction was rapid, and upon the whole no permanent improvement was reached. Deglutition was still fairly well accomplished. After about one month from the commencement of the use of the galvano-cautery the difficulty in breathing became worse, spasms of the respiratory muscles occurred, food and drink passed into the larynx, and on several occasions there seemed to be immediate danger to life. I therefore performed tracheotomy, with relief of all the alarming symptoms. He lived eight months and a few days after the operation. The post-mortem revealed an extensive epithelioma involving the whole of the right half of the larynx, and also the left portion of the supraglottic structures. The microscopic examination left no doubt as to the character of the tumor. The lymphatic glands were not enlarged and were not removed.

Case IV.—X., male, aged forty-five, has had for the last two years a swelling in the right side of the neck, lately getting large, and within the last few months he has had difficulty in speaking and quite recently dyspnœa, especially at night. There is excessive secretion of saliva and mucus of the pharynx, and at the time of examination there is behind and including the sterno-mastoid of the right side a tumor, rounded in shape, firm to the feel, not especially tender upon manipulation. It is about two inches and a half in diameter and seems to be deeply seated; not easily movable. There is also a hard, irregular mass of tissue extending from this tumor downward and inward along the side of the larynx. Examination with the laryngoscope reveals a smooth, reddish tumefaction of the right arytenoid, together with the supraglottic structures, upon the same side. This swelling encroaches upon the glottis so as to produce the dyspnœa and dysphonia. There are no chest symptoms or morbid signs. The surface of the growth is not ulcerated, and I think we must conclude that it is not tubercular. The surgeon in attendance diagnosticated the external tumor as cancer. Tracheotomy was advised for the relief of the dyspnœa, but the patient, who was from a distant point, declined unless the whole tumor could be removed. He returned home, and I have been unable to get any further history of the case.

The interest in it consists chiefly in the fact that the malignant disease in the larynx developed after the appearance of the external cancer. This, I think, is extremely rare, and one can hardly understand how it is accomplished except by extension directly. As there was a line of hardened tissue extending from the original tumor downward and inward along the side of the larynx, I presume this must have been the way by which the larynx became involved. I may remark that I could not get from the patient, who was a very

intelligent person, any history of laryngeal trouble prior to the appearance of the external tumor.

Case V.—F., male, aged fifty-four. Office work. Antecedents good. No family history of lung trouble, but his mother had died of cancer. General health good till about one year before consultation, when he began to have some discomfort in the throat, not marked and hardly enough to attract his attention. For the last few months this has been getting worse. He comes to the city for advice. I find that he has great difficulty in swallowing, can get down only liquid food, and this gets into the larynx; as a result he is very much emaciated and his strength is exhausted. Dyspnœa constant. Inspiration more difficult than expiration, but both labored, especially so at night. A few days ago he had a severe hæmorrhage from the larynx. Secretions of bowels and kidneys not abnormal.

Examination of the larynx reveals a dark reddish mass springing from the right side or wall of the larynx above the glottis; of the precise seat, however, I am not quite sure, and, as the tumor bleeds upon the slightest touch with the probe, I dare not attempt to examine it further. It partly fills the vestibule of the larynx and is fairly represented by the accompanying sketch. As a provisional measure I performed tracheotomy. Indeed, it seemed to me that there was danger of his dying at almost any time from the difficulty of breathing. There has been a constant tendency to hæmorrhage, but nothing alarming occurred while under observation. His general health improved, he swallowed better, had a fair appetite, slept comfortably, and after a few weeks returned to his home in a distant State. The question of partial extirpation of the larynx was considered, and when he left, it was with the understanding that in a few weeks he would return for re-examination. Soon after he reached home, however, the hæmorrhages became frequent and copious, and there began to develop swelling and tenderness in the lymphatics along the right side of the neck; none on the left side. In about three months he did return. I found the lymphatics as stated above. The growth evidently involved more of the structure of the larynx. The secretions of mucus were more copious. He had lost his appetite, but swallowed fairly well; breathed easily through the cannula, did not suffer much pain, slept fairly well, and desired to have the whole tumor removed. It seemed to me that the evident complications of the ganglia justified the conclusion that the system was already infected, and I advised a further postponement of an operation. Dr. Ingals, who saw the patient with me, concurred in that opinion. He returned home and rapidly declined, and died about six weeks after the last consultation, and a little more than five months after the trache-

otomy. No post-mortem was made, and I am only able to conjecture that the tumor was an encephaloid, and mainly from the fact that it seemed to be so soft and easily broken.

In conclusion, I beg to call attention to the facts:

1. That all of the five patients were males, the youngest forty-five years old.

2. That of the five cases, the growth was evidently from the right side in three cases, from the left side in one case, and in the remaining case probably from the left side.

3. That in only one case was there a history of cancer in the family, in the mother of the patient (Case V).

4. That in one case the disease seemed to be secondary or an extension of an external cancer.

5. That in one case only was there any evidence of infection of the lymphatics from the larynx.

6. That in only one case was there any troublesome hæmorrhage.

7. That in none was there marked pain in the larynx.

8. That in three cases tracheotomy was performed, and the patients' lives were prolonged apparently three, five, and eight months respectively.

Paper.

A CASE OF RECURRING HÆMORRHAGE OF THE VOCAL BAND.

By C. E. BEAN, M. D.

AS I have been able to find so little recorded on the subject of hæmorrhage of the vocal cord, I have deemed the following case worthy of mention:

Mr. A., tobacco merchant, consulted me in the latter part of May, 1884, for the relief of a nose and throat complication of several years' duration. Examination of the parts revealed a hypertrophic rhinitis, follicular pharyngitis, and superficial inflammation of both vocal bands.

He was under my treatment at that time for three months, when he was discharged as entirely relieved.

In July, 1885, he again consulted me for a sudden hoarseness, following a violent paroxysm of coughing. Both vocal bands were inflamed, the right one appearing much the worse. He was under treatment at this time for only a week, when he had to leave the city. On his return, in two weeks, I found both vocal bands perfectly normal in appearance, and all his hoarseness had disappeared.

In September of the same year he again visited me, complaining of the same thing, stating that for two or three days he had had to use his voice more than usual, and the day before seeing me there had been a great deal of dust where he had been working, this causing almost constant coughing. There was no pain in the throat, the voice more husky than hoarse, and a constant inclination to clear his throat of some foreign material.

Upon examining his larynx, I found the left vocal band in a normal condition; the right one was swollen, and of a dark-red color. Remembering a case I had seen under Dr. Cohen's care, I concluded this was a hæmorrhage of the vocal cord.

I applied, by means of a cotton carrier, a solution of nitrate of silver (gr. xxx–lx to ℥ j), varying it with a spray of sulphate of zinc (gr. lx to ℥ j), but it apparently was of no benefit, and it was the 1st of November, nearly two months after I saw him, before the band was normal in appearance, although it had been reduced to its natural size.

On the 1st of February, 1886, he again applied to me for the relief of the same difficulty, following violent coughing. The left vocal band was normal in appearance; the right one was almost black and swollen. I again used a spray of sulphate of zinc (gr. xl–lx to ℥ j), applied three times a week, and the vocal band cleared to its normal color the middle of March.

I saw him no more until the 18th of August, when all the old symptoms had suddenly reappeared. The right band was of a dull-red color; but on phonation the glistening membrane could be seen above the discoloration. I made no application at this time, but directed him to use his voice as little as possible, and gave him internally extract of ergot, in half-grain doses, three times a day. I examined the larynx once or twice a week. In about three weeks the band had entirely cleared. Since that time he has been taking extract of ergot at intervals, and, by being careful in the use of his voice, has had no recurrence of the complication.

The suddenness of the attacks, coming on only after violent coughing caused by the inhalation of irritant substances, the absence of all pain during the attack, the limitation to one vocal band, and the peculiar color of the part affected, seem to me to leave no doubt as to the diagnosis. I examined his lungs repeatedly, but could find no lesion there. During the last year he has gained in flesh and strength, and at this writing his larynx is entirely free from any appearance of his former trouble.

Paper.

A CASE OF LARYNGEAL STENOSIS TREATED BY DIVULSION AND SYSTEMATIC DILATATION.

By MORRIS J. ASCH, M. D.

THE following case is interesting from the character of the stenosis, from the success of the treatment, and also from the obscurity of the cause producing the stenosis:

Miss K., aged thirty, a music-teacher, presented herself at the throat clinic of the New York Eye and Ear Infirmary, October 4, 1885, with the following history: Up to her twenty-seventh year she had always enjoyed good health. At that period she had some pulmonary trouble of the nature of which she was ignorant. Subsequently she had always a slight cough, but no other symptoms. No diminution in weight; no hæmoptysis or night-sweats. In October, 1884, she first noticed a slight wheezing on inspiration, accompanied by a short spasmodic cough, which gradually increased in severity until May, 1885, when the dyspnœa became excessive. She was treated at the dispensary of one of our large hospitals for asthma without obtaining relief, and was finally pronounced incurable, a change of climate being recommended as the only means of procuring comfort. At the time she presented herself at my clinic her dyspnœa was excessive at intervals. She breathed with her mouth widely opened, inspiring with a stridulous, gasping sound, which could be heard in an adjoining room. The slightest exertion increased the dyspnœa, which, however, was ameliorated on lying down, the only position in which she was comparatively comfortable. The voice was clear, though not strong; the heart-sounds were weak, with loud sibilant râles over the whole chest; and there was dullness under the left clavicle. The appetite was good, and all the functions were normal.

Examination with the laryngoscope showed no abnormity in the larynx above the cords, nor in the cords themselves, but on deep inspiration the origin of the trouble was revealed below the vocal cords. At the level of the cricoid cartilage, and encircling the opening of the trachea, were seen two pale, thick, shining swellings, united posteriorly by a membranous expansion, and leaving the anterior wall free, which diminished the opening of the larynx to a third of its natural size. The membranous portion of this swelling was double, there being two folds of it at different levels. When the patient presented herself again, on October 20th, the membranous expansion posteriorly was nicked by means of Whistler's laryngotome, and the stricture divulsed by means of a long laryngeal forceps opening laterally. A small amount of blood followed the operation, and for several hours there was a good deal of coughing. After this the

patient was very comfortable, the dyspnœa was materially lessened, and she was able to ascend a flight of stairs without exhaustion, a thing which she had been unable to do for two years.

On October 22d the patient was seen again, and the caliber of the stricture seen to be materially enlarged, the constricting band being now divided into two crescent-shaped lateral portions. The breathing was still loud, but with barely any effort and with only occasional gasps. Metallic sounds were passed into the trachea daily, and dilatation with the forceps was performed tri-weekly. The noisy respiration having now ceased, the chest was examined, and bronchial respiration found to be quite marked. From this time the patient gradually improved, the stretching with the forceps being regularly performed by my assistant in the clinic, Dr. Emil Mayer.

As time went on the dilatations were performed less frequently until February 8, 1886, when Dr. Mayer reported the patient much improved, the caliber of the stricture enlarged, and the breathing almost noiseless.

In April an attack of bronchitis supervened, and with it the dyspnœa recurred, but the continued dilatation soon relieved this. The patient's condition improved, and she became less regular in her attendance.

On September 2d the patient presented herself at my office in such an extreme state of dyspnœa as to almost warrant an immediate tracheotomy. I examined her larynx, and found it to be acutely inflamed at the seat of the stricture, while the crescentic bands were enlarged to such a degree as to leave the merest chink for the passage of air. In a little while there was a lessening of the extreme dyspnœa, so that she was able to be transported to the infirmary, where she was put to bed, and, under the use of steam and cold compresses to the throat, the acute symptoms subsided and the larynx was restored to its previous caliber. Dilatation by O'Dwyer's tubes was then tried, but the patient was unable to tolerate this method, spasm of the larynx being caused by it.

Dilatation was then begun with Schrötter's hard-rubber tubes, commencing with No. 3. They were introduced every other day, being retained from five to fifteen minutes at a sitting, and the size increased as the treatment progressed. From this time the improvement was steady and manifest; the patient tolerated the presence of the tube without difficulty, and in three months from the adoption of the method the caliber of the larynx and trachea was restored, and the cure was perfect. At the time of this writing (May, 1887) she has no asthma, the respiration is natural, and she can perform her duties without inconvenience in this respect, but, unfortunately, the symptoms of pulmonary disease have increased.

There was in this case no history of syphilis nor knowledge of any inflammation of the larynx or trachea; it was evidently a case of subchordal hypertrophic laryngitis, described by Gerhardt in 1873 under the name of "chorditis vocalis inferior hypertrophica," and

cases of which have been reported by Schrötter, Burow, Marian, Ganghofner, Chiari, and others. The disease, when seated in the larynx, shows itself first by hoarseness; if, however, it is below the cords, then dyspnœa is the first symptom. There is probably a history of inflammation of the throat at some previous time; then dyspnœa appears, and, as soon as the thickening is of sufficient volume, suffocative attacks occur, often attended by complete aphonia. The usual seat of the disease is below the cords. The nature of the disease is in doubt. Its immediate cause is undoubtedly catarrhal inflammation of the mucous membrane, while the patients are generally of a strumous constitution. It may, however, result from tuberculous inflammation, which, Chiari says, can produce swelling below the cords.

In the treatment of these cases systematic dilatation by means of the tubes of Professor Schrötter is the best method to pursue. A striking point in the history of the present case is the rapid amelioration brought about by the use of these tubes, and the permanency of the good effects produced by them. In all cases of stenosis where a tube can be introduced there can be no question as to the propriety of attempting this method in preference to tracheotomy. An English catheter can be introduced, increasing in size until one of the hard-rubber tubes can be inserted, and the patient can soon be taught how to introduce it himself. If, however, the dilatation is pushed too rapidly, and a tube of unsuitable size is forced, severe reaction may occur, causing swelling, and the dyspnœa may be increased to such an extent as to render an artificial opening imperative. There is no question in my mind as to the preference to be given to this method over any other that we possess. In cases where urgency exists, of course a surgical procedure may be unavoidable; but in cases of chronic stenosis the tube is indicated, especially where it is the result of chronic inflammation. In cases where the stricture is the result of wounds, or of cicatrization following loss of tissue, or where acute stenosis is present, tubage should not be employed; in the one case it would be powerless to exert any permanent improvement, and in the other the reaction would aggravate the original disease. Yet, in cases of emergency, respiration might be maintained by its means until tracheotomy could be performed. In cases of stenosis existing low in the trachea, tubes of a different curve from the laryngeal tube must be employed.

The question of the cause of the stenosis in the case I have just reported is an interesting one. Was it the result of simple catarrhal

inflammation in a strumous subject, or had the condition of the lung which manifested itself later on any effect in the production of this swelling? Certainly we have not been accustomed to look for the early laryngeal manifestations of phthisis so low in the air-passages, and yet it is possible that they may present themselves in this locality more frequently than has been supposed; and if we examine closely into all our cases of stenosis it is possible that we may occasionally find tubercle to be a factor in its production.

Discussion.

Dr. J. Solis-Cohen: My experience in the treatment of these stenoses has not been very extensive. The first case I reported occurred twenty years ago—that of a patient in whom I removed a morbid growth from the interior of the larynx by thyreotomy, having first used the galvano-cautery. This was probably the first time the galvano-cautery was used in this country. I had tried to remove the growth by the forceps, etc., and then made use of a galvano-cautery specially prepared. The patient experienced so little pain by this method that he would accept no other treatment. The growth was examined in different cities, and was pronounced to be epithelioma. But this was a mistake, for the man is still living. But because of that diagnosis I stopped my other treatment, separated the thyreoid cartilage, and removed the tumor with most of the vocal band to which it was attached. Preliminary tracheotomy had been performed ten days before. After the parts had healed there was adhesion of the sound vocal band to the tissues on the opposite side. I then devised an instrument very much like the more recent one of Whistler's, modeled upon the urethrotome, having a tapering point, and with it divided the web, and afterward used the galvano-cautery. I have used that instrument since, but I have never had the courage to attempt dilatation without preliminary tracheotomy. I know it has been done in several cases, and also that immediate tracheotomy has become necessary. I think it is better to perform tracheotomy first so as to have nothing interfere with the breathing of the patient, and then proceed in the most active way of treating it. Under antiseptic surgery the tracheal wound heals up in a very short time, with trifling risk to the patient. The experience which I have had with the Schrötter dilators has been that after a little while the parts contract again, and, unless the patient can be retained under almost continuous observation for many months, the results are not apt to be permanent. One reason why I have not treated many patients with stenosis is, not so much that they have not presented themselves, but that I have impressed them with the fact that they must put themselves under treatment six months, with a prospect of extending it to eighteen months, before they could be promised much permanent relief.

Dr. F. I. Knight: This method of treatment has been very slowly

popularized, in this country at any rate. I know of very few cases in which dilatation of strictures has been attempted, probably for the reason that everybody fears subsequent contraction and prolonged disagreeable treatment. I would particularly object to the name which has got into literature—chorditis inferior hypertrophica. There is no chorditis and there is no hypertrophy. It is a subglottic laryngitis, sometimes a perichondritis of the cricoid. I think it would be better to call it simply subglottic laryngitis.

Dr. Morgan: I have recently treated an instructive case of laryngeal stenosis. During a period of eight or more months I was enabled to control the advances of the disease by the administration of potassium iodide internally and by intra-laryngeal applications of iodo-glycerin. The disease, nevertheless, on several occasions advanced so far and the dyspnœa became so urgent, in spite of the medical treatment and the use of dilators, that tracheotomy was advised, to be followed by systematic dilatation. The patient, although fully warned of his peril, postponed the operation from week to week, continuing to have suffocative spells nightly, to one of which he finally succumbed. I think that, if a preliminary tracheotomy had been allowed and subsequent dilatation had been practiced, the patient, who was of good physique, would have been living to-day.

Dr. Delavan: The treatment of chronic cases of stenosis is likely to undergo a radical change through the introduction of O'Dwyer's method of intubation. I think that this measure has a most brilliant future before it. It seems hardly necessary for me to give the reasons for this opinion. The tube can be worn for any length of time, respiration goes on meanwhile, and dilatation is kept up for a considerable interval. I know that Dr. O'Dwyer has had some experience in this direction, but, on account of his modesty and the fact that a description of the tube for adults has not yet been published, we have heard little about it. I believe that this is the coming method for the treatment of these cases, either with previous forced dilatation or incision or without.

Dr. Asch: With regard to Dr. Solis-Cohen having found this method unsatisfactory in most cases, and advising tracheotomy, I would say that, to me, the beauty of this operation is that in employing it we avoid tracheotomy. In this case it certainly did seem as if tracheotomy would be necessary, but most patients have such a horror of any bloody operation that they would much rather undergo divulsion, even if it is more troublesome. I told this patient, as Dr. Solis-Cohen tells his patients, that the treatment would take a long while, and it did take from May of one year until February of the next. In a case of syphilitic stenosis of the larynx in which I attempted this method, but without success, because the man would not remain long enough in the city, the relief was instantaneous; he would, in fact, insert the tube, such was the relief he experienced, and I believe he would have tried it alone had I not feared he might set up acute inflammation. With regard to the name referred to by

Dr. Knight. I simply quoted from another writer. I think the proper name for it is subglottic inflammation, or subchordal hypertrophic laryngitis. Regarding O'Dwyer's tubes, they seemed to be indicated in this case, and I tried them, but the patient for some reason was not able to tolerate them. The tube was coughed out with violent spasm, and I gave it up after making two or three attempts. The objection to the method I should suppose would be the difficulty of swallowing.

Paper.

ON THE ÆTIOLOGY OF DEFLECTIONS OF THE NASAL SEPTUM.

By D. BRYSON DELAVAN, M. D.

DEFLECTIONS of the septum, one of the most common conditions of nasal deformity seen at the present day, have been recognized more or less intelligently for many years. Comparing, however, the accessions of knowledge made during the past decade with the amount formerly known of them, we are forced to believe that a new era in their history has been opened, and that the full recognition of their nature and pathological significance has been fairly established.

With regard to their ætiology, however, much obscurity exists, and while this department of knowledge concerning them is full of interest and importance, it is only possible to find here and there a reliable suggestion regarding it. It has seemed well, therefore, to gather together in one article some of the scattered views upon the subject already advanced, and to bring forward at the same time certain observations and deductions which, in the course of a somewhat careful survey, have occurred to the writer.

And first, as introductory to the main topic and calculated to throw light upon many of its phenomena, it will be well to consider hastily some of the factors concerned in the development of the special and accessory structures which together compose the nasal organ, and to study their possible influence upon the abnormal conditions with which we have to deal. Watson tells us that in the infant the nasal fossæ are relatively smaller in size and much less complex than in the adult, their vertical diameter being remarkably small, the sinuses being not yet formed, and the lateral masses of the ethmoid being still cartilaginous. The cribriform plate of the ethmoid at birth is a mere membranous plane, continuous with the

falx cerebri of the dura mater, and attached behind to the partially ossified body of the sphenoid. The vertical plate of the ethmoid, in other words, is cartilaginous at this period, while the vomer is already ossified. Some months after birth the nasal fossæ extend in all their diameters, and the different sinuses are developed. At the age of two years the frontal sinuses and ethmoidal cells have begun to form, simultaneously with the hollowing out of the antrum of Highmore.

This late development of the central portions of the skull provides not only for a certain amount of mobility in the bones during parturition, but, what is of no less importance, enables the alteration in bulk of the surrounding bones and cavities in the process of growth to go on without any rigid impediment in the center, and the full development of the soft tissues, and especially of the nerves, is possible without the risk of compression by the encroachment of bony deposits in the channels for their transmission.

From what has been said it is plain that, in the history of the development of the nose in the infant, the septum is one of the last parts to assume its ultimate form. Indeed, Zuckerkandl maintains that during this formative period it is always straight, and that deflections do not occur until the seventh year. This latter view, from clinical observation, the writer is inclined to doubt.

Again, the turbinated bones are not formed until a late period in the development of the fœtus, the inferior turbinated bone being ossified from a single center, which only appears at birth (Quain).

It follows, naturally, that the tardy development of these parts is succeeded later in the history of the individual by a very considerable activity of growth.

Finally, it will appear that: (*a*) There is an inequality of development at the outset, the vomer being ossified while the perpendicular plate of the ethmoid is still membranous, and the turbinated bones practically yet unformed. (*b*) That the process of development goes on with great rapidity at certain periods after birth. (*c*) That any considerable condition of development is not probable before the age of seven years. (*d*) Again, the posterior free border of the vomer, looking toward the pharynx, is, as a matter of clinical observation, almost invariably straight. This portion of the bone is also particularly thick and strong. Its vertical diameter is decidedly less than that of the more anterior part, and it is situated remote from the probability of injury. It therefore seems reasonable to suppose that the straight position is the one assumed at the outset, and that it is

maintained posteriorly by reason of the inherent strength of this part of the vomer, by its short diameter, and by its protected situation.

The anterior aspect of the vomer, for exactly contrary reasons, is liable to displacement, and, as a matter of fact, these displacements commonly exist.

These considerations all point directly to the inference that the septum—made up of several plates unequal in strength and in the power of resisting compression, uneven also in development, and, finally, incased in an unyielding cavity closed by the ethmoid above and firmly buttressed by the arch of the palate below—bends in the direction of the least resistance, and, as the process of growth goes on, overdevelopment is attended with a pushing aside of the various parts from their normal planes, and thus the production of deflection results. It is probable that many of the so-called congenital deflections may be thus explained.

The causes of deflection of the septum may be divided into two principal groups:

I. The predisposing.

II. The exciting.

The predisposing causes are:

(*a*) Race.

(*b*) Diathesis.

(*a*) One of the most important and interesting questions connected with this subject is the influence of race upon the development of the nose. That a predisposition toward certain marked characteristics of form should exist among the representatives of a given race is beyond a doubt. Thus, among the ancients, the Assyrian and the Grecian, the negro and the Roman, all presented external characteristics which were unmistakable, and which clearly identified the wearer as belonging to his own particular division of the human family. To-day, as before, the same conditions of race peculiarity prevail, the varieties of form observed among people of the same region being due, in all probability, to the general commingling of races which has occurred throughout many parts of Europe.

Nor is it in the external resemblance alone that this tendency is displayed. The general shape and arrangement of the interior framework of the nose seem to follow the example of its outer contour, and the development of deviations from the normal to occur far more commonly in certain types of man than in others.

In the course of studies made upon many thousands of specimens,

both in this country and in Europe, the writer has found several suggestive facts:

1. That among European races deflections of the septum are of common occurrence, 50 per cent. of all specimens showing a greater or less degree of deviation.

2. Of the different nationalities of Europe at the present day, the highest proportion of deformed septa is found among the Sclavonic and Hebrew races. Thus skulls of Russians, Bohemians, Poles, and Hungarians are more apt to show deflected septa than those of the Germanic, Celtic, and Norman types.

3. In the anthropological collection of the Peabody Museum at Cambridge, Mass., is a cabinet containing eighteen well-preserved specimens of skulls taken from ancient Roman tombs. Among these there is hardly a single instance in which the septum is straight, while in seven of them the degree of deflection is excessive, and far beyond that usually seen.

From this it would appear that the aquiline type of nose, as illustrated in the Sclav, the Hebrew, and the ancient Roman, is particularly apt to be associated with deflection, and there are many mechanical reasons why this statement should be true.

Strange to say, however, the type found by the writer to be freest from deformity of the septum is the American Indian, in whom the aquiline nose is characteristic. Indeed, among hundreds of specimens, it has been difficult to find a well-marked example of deflection, and, of the few discovered, the degree of deflection was generally very slight.

Again, among the Grecian type, deformities of the septum are common, and sometimes severe. These cases, as well as those of aquiline type, are often associated with a high-arched condition of the hard palate; in other words, there is in them a tendency toward the throwing upward of the palatine arch, and a corresponding projection forward of the nasal prominences of the superior maxillary bones.

The general drift of the testimony offered by anthropological collections containing a variety of types is toward the fact that, among primitive types, deformities are rare, while among types representing the highly civilized and luxurious they are of such common occurrence as to become almost the rule. The reason of this may be fairly based upon the following explanation—namely, that in the production of deflections of the septum chronic catarrhal conditions are an important factor, for we know that amid the surroundings

of a high state of civilization, or rather of an overcrowded population, there flourish the very conditions of bad hygiene, lack of exercise, overfeeding, mouth-breathing, diathesis, etc., under which catarrh is most apt to occur.

A second predisposing cause of septal deflection is diathesis.

In patients suffering from the rhachitic, the strumous, the tubercular, or the syphilitic dyscrasia, deformities of the septum are common, as may be readily observed among such subjects in clinical practice.

II. The exciting causes of deflection of the septum are:

(*a*) Traumatism.

(*b*) Local malnutrition.

(*c*) Occlusion of the respiratory passages of the nose.

(*a*) *Traumatism.*—In a series of examinations made by Dr. J. W. Robertson, of Detroit, it was found that of two hundred and seventeen subjects of nasal deformity, eighty-three gave histories of injury having been received; and of the ninety-seven remaining, having no such histories, one half had received injuries in early life which had been forgotten, since many of them had dislocations of the cartilages and fractures of the nasal bones, which could only have been the results of external violence. It would appear from the foregoing that a large percentage was directly due to traumatism. As to the ages at which their deformities occurred, in a total of one hundred and sixty-one children from two to ten years old, only seven deformities existed. Four of these gave histories of injury. In a total of seventy-two children between ten and twenty, there were found twenty-two deformed noses. Of these, six gave histories of injury, while in sixteen the causes were unknown, although five had dislocation of the septum, and one had disarticulation and depression of the nasal bones. A number of these cases were not due to injury gave histories of syphilis, scrofula, or tuberculosis. It would appear, therefore, from these statistics, that a large proportion of nasal deformities manifest themselves between the ages of ten and twenty, a period of great constructive activity, either through the receipt of injuries or through improper development due to malnutrition.

(*b*) *Local malnutrition*, as was pointed out by Dr. Ingals in his paper read before this association in 1882, is an important factor in the production of deflection. It is even more influential in the formation of the bony spurs, crests, or ridges commonly found at the line of junction of the vomer with the maxillary ridge, and which may so effectually occlude the anterior nares. While it is highly

probable that such deformities often originate from injury, it can not be questioned that they are observed to increase regularly in size, under conditions of inflammation of the overlying mucous membrane and consequent supernutrition of the denser parts of the adjacent bone, until dimensions far beyond the original are attained.

Again, deviation of the septum may be associated with general asymmetry of the nasal fossæ.

Such asymmetry, although usually considered congenital, is probably, in most instances at least, due to causes occurring during the growth of the child. The view that stenosis of one nasal fossa may, through the withdrawal from that fossa of its proper nutrition, cause an inharmonious development of that one as compared with its fellow, seems, according to Ziem, to be strengthened by the results obtained by excluding the entrance of air from one nostril in young animals. In these, it has been observed, there was developed a deviation of the intermaxillary bone and of the sagittal suture toward the occluded side; also shortening of the nasal bone, frontal bone, and horizontal plate of the palate bone of the same side; flattening of the alveolar processes; reduction of the distance between the auditory canal and the alveolar process, as well as between the zygomatic arch and the supra-orbital border, and smaller size and asymmetrical position of the vascular and nerve canals on the closed side of the nose, together with inequality of the distance of the two orbits from the median line.

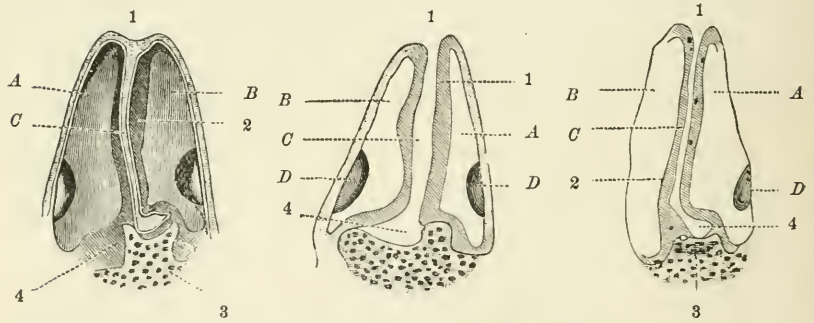
It is easy to believe that occlusion of one nasal fossa in a growing child by a large turbinated hypertrophy, unilateral hypertrophied tonsil, or adenoid growth at the pharyngeal vault, might, by depriving the occluded side of its proper nutrition, cause general asymmetry, and, with it, serious conditions of deflection.

Finally, occlusion of both nasal fossæ, from any cause, is capable of making the patient a mouth-breather. Now, one of the diagnostic signs of habitual mouth-breathing is the high-arched, narrow, hard palate, associated with which deflection is so often found. The explanation of this must lie in the fact that the septum is crowded upward by the hard palate until it can no longer resist the pressure brought to bear upon it, and deflection results. The cause of the palatal deformity seems most readily explained upon the theory of atmospheric pressure, occlusion of the nasal passages creating in them, through the act of inspiration, a partial vacuum, and thus disturbing the equilibrium of pressure upon the upper and the lower aspect of the roof of the mouth. This inequality of atmospheric

pressure, exerted during the infancy and early growth of the child, is sufficient, as seems in many cases probable, to give rise to a permanent condition of deformity of the hard palate, and thus to interfere with the normal development of the septum, which, in turn, is still further distorted by the abolition of the natural process of nasal respiration.

In addition to the more serious conditions of deflection of the bony parts there are commonly found deviations and deformities of the anterior or cartilaginous portion of the nasal septum which are sufficiently pronounced to cause discomfort and to merit attention. They are probably of traumatic origin in nearly every instance. It is not uncommon, either, for the surgeon to see recent cases of actual dislocation of the cartilaginous septum resulting from recognized causes of injury.

Some of these are well illustrated in the accompanying cuts.



Vertical sections through the cartilaginous septum in three different noses. (From Moure, after Löwenberg.)

A, vertical section of the right nasal fossa; *B*, vertical section of the left nasal fossa; *C*, section of the septum; *D*, anterior extremity of the inferior turbinated; 1, cartilage of the septum; 2, Schneiderian membrane covering both sides of the septum; 3, maxillary ridge.

These, however, are more apt to be due to the habitual bending of the tip of the nose in a given direction, as in blowing the nose with one and the same hand, and, since it is a matter of history that misshapen alæ in the young may be made straight by a process of systematic molding, there seems no reason why the converse should not be true. The last-mentioned conditions are important, and deserve more care than they have hitherto received.

From causes so diverse as those which have been herewith presented, and in an organ the size of which is considerable and the relations of which are somewhat complex, it follows that the structural deformities which may occur are greatly varied, both as to

character, position, and degree. To discuss them in detail does not come within the limit of this paper, and is besides unnecessary, since they have been well described elsewhere by other writers. It is probable that with a better understanding of the subject the special causes of the different recognized forms of deflection will be more precisely classified. At present we may hazard the following general statement:

1. That deflections of the cartilaginous septum are due, as a rule, to trauma.

2. Bony ridges along the line of suture of the septum with the superior maxillary bone are often initiated by trauma, and subsequently aggravated by hypernutrition; otherwise they are due to hypernutrition alone.

3. Deflections of the nasal septum proper may be due either to trauma or to improper nutrition. They are generally due to the latter if situated posteriorly.

In conclusion, it must suggest itself to all that variety of deformity demands variety of treatment, and that to meet the requirements of each case many different expedients must be employed. It is as impossible to relieve all of the various forms of deflection of the septum by any one method of operation as it would be to treat all fractures occurring from the ankle to the hip with one form of apparatus.

Discussion.

Dr. E. C. Morgan: I wish to express my gratitude to Dr. Delavan not only for the valuable paper which he has presented to-day, but also for the exhaustive investigations which he has made in the past regarding the question of deformities of the nasal fossæ. As to the ætiology of deflected nasal septa, I can, from a clinical standpoint, say, so far as my observation goes, I have been able in nearly every case to trace the deflected septum to traumatism. At first the history may have been somewhat obscure, but it has been cleared up by investigation. Some member of the family has been able to recall the fact that the patient at an early period of life sustained an injury to the nasal organ. Concerning the apparent immunity from deformity of the nasal septum enjoyed by uncivilized or partially civilized races, I will again say that my clinical experience with the African race in the hospitals at Washington has been large, and I have seen deflection of the nasal septum but very rarely. I have not investigated the subject from a statistical standpoint, for my attention was called to it for the first time by Dr. Delavan's paper.

Dr. F. Donaldson, Jr.: As to deflection of the nasal septum in the colored race, I had for some years a large dispensary practice among

these people, and I believe that this deformity is not so common with them as with the white race.

Dr. C. E. Sajous: So far as the ætiology of deflection of the nasal septum is concerned, I hardly think that traumatism can be clearly defined in every case, for, as Dr. Cohen says, all children get bumps on the nose. We know how elastic the end of the nose is, and the general elasticity of the nasal structures is in proportion to the youthfulness of the person. I therefore think that in trying to trace a history of traumatism we should not go back of a certain age, say seven years. Of course an exception would be made where much deformity existed which could be traced directly to a severe blow before the seventh year. With regard to the indications of treatment when there is deflection of the nose, if I find that the patient has diminished breathing capacity through the nose, that he has to breathe through the mouth, I institute treatment; but if he makes no complaint, and I see that respiration through the nose is satisfactory, I leave it alone, for those operations at best are often unsatisfactory, correction of the deformity frequently proving fruitless. With regard to the procedure to be adopted, I quite agree with Dr. Delavan that it is a mistake to try to establish a fixed measure for all cases. In one you will require the punch, in another the saw, in another the burr, and in most of them you will not require those things at all. It seldom occurs that out of twenty cases you will find any two having any resemblance whatever.

Dr. J. Solis-Cohen: This is a very obscure subject. Of course we are all very much indebted for the light which has been thrown upon it by this review of matter relating to the ætiology. While it is well known that the colored people of the South have a large admixture of the Caucasian blood, still it is true that they have large nostrils, with probably less obstruction to nasal respiration, and that would account for their having a straighter septum than white people, and would go to support the theory of the writer of the paper. The American Indians make it a point to breathe through the nose. When they sleep they sometimes place the hands over the mouth for the purpose of preventing mouth-breathing. Since my attention was directed to the subject of deformity of the palate by the articles of Dr. Jarvis and others, I have examined all my patients with regard to that point, and, while I must agree that in the majority of cases this deformity of the palate and deflection of the septum go together, I am equally positive that in a great many cases of deflection of the septum there is a fairly normal arch, and that there may be a high arch without a deflected septum. While speaking on this subject I would mention an observation which I have often made, but which, as far as I know, has not attracted the attention of others—viz., that besides the arching of the roof of the mouth there is often something which looks like an exostosis at the roof of the palate. It may be that in these cases there is a greater tuberosity, a greater outgrowth of bone, both of the superior maxillary bone and of the nasal septum. Since the statement was made that children have a vertical septum I have given attention to that point, and have

found that in a great many children the septum is deflected although they have not yet attained to the seventh year. With regard to traumatism, of course we know that nurses will drop the children, that boys will fight, and so on, and it is difficult to eliminate this factor, and it is hard to say how many cases are due to that. In conclusion, I would most emphatically state that I have seen over and over again cases in which there was marked deflection of the nasal septum, and in which there was no difficulty at all in respiration.

Dr. J. N. Mackenzie: I rise to congratulate Dr. Delavan on the admirable paper which he has given us. It is a subject in which I am very much interested myself, and which I dealt with in an elaborate manner some years ago ("Transactions of the Virginia State Medical Society," 1883.) I wish, therefore, to make some remarks upon certain of the points which have been raised. With regard to race peculiarities, I do not recall a single case of deflection of the septum in an African in which I have been obliged to operate. Yet I see a great many Africans at my clinic in Baltimore. I have seen deflection of the septum in them, but not demanding operation. A good many factors enter into the question of race peculiarities, among which national customs may exert some influence. Among some races the nose is carefully molded during infancy. In Detroit I called attention to the custom of the ancient Persians, especially those in the higher walks of life, who molded the nose of their offspring so that the septum would be perfectly straight. No Persian was allowed to sit on the throne unless he had a perfectly straight septum and a correspondingly good-looking nose. With regard to the congenital origin of these deflections, while the positions taken by Dr. Delavan are excellent, still it seems to me not impossible that the deformity may occur during intra-uterine life. There may be some changes in development during the fœtal state which may give rise to deformity of the septum. I think that in a certain proportion of cases the suggestion made years ago by Morgagni may have some weight—namely, that the deflection may be due to the rapid growth of the septum and comparatively slow growth of the surrounding parts. The suggestion of Follin and Duplay, which has been referred to by Dr. Jarvis, regarding the influence of the development of the palatine arch, etc., may be an important one, but the great exciting cause is unquestionably traumatism. In the vast majority of cases where patients present themselves for treatment it will be found, on close inquiry, that the lesion originated in trauma. Especially is this true of deformity of the cartilaginous septum.

Dr. Delavan's remark at the close of his paper was certainly a very pertinent one. It is utterly absurd to say that one method of treatment will be efficacious in every case. The spurs which are so common in the nasal cavity are by no means always of sufficient importance to be sawed off, or pinched off, or dealt with in a very radical manner. In the majority of those cases, unless some obstructive lesion exists, I find there is very little difficulty in breathing through the nose, and I let them alone

unless there is some irritative process which may be removed by division of the spur. I think the septum is too often and too violently assailed. While in cases that require treatment I would not hesitate to perform any operation, still I think we ought to select our cases.

Dr. T. A. De Blois: There is a class of cases I have not heard spoken of—namely, the nose of the pugilist. During the past winter a number of prominent pugilists have been under my care, and my wonder has been excited that in them the septum is so little deflected. The nasal bones may have been seriously injured, and the nose itself spread all over the face, yet the septum will remain wonderfully straight. I can recall the case of a well-known man whose nose has been completely broken over and over again, yet whose septum is in a right line, and whose nasal respiration is exceedingly good. Last winter I saw a pugilist immediately after the cartilaginous septum had been separated from the bony septum. It was very easily put back into place. He had not had a deflected septum from his previous experience. What is remarkable in these cases is the immense size of the lower turbinated bones anteriorly. It seemed to me that the beating which these people get increases the size of the turbinated bones a great deal more than of the septum. I suppose these could certainly be considered traumatic cases.

Dr. J. O. Roe: The most frequent result from injury to the nose in children, in the cases which have come under my observation, is dislocation of the triangular cartilage. This is an injury which has been very slightly alluded to. In a number of instances I have seen this cartilage so dislocated as to almost completely occlude both nostrils—one by the bulging outward at the point of dislocation, and the other by the end of the cartilage being turned across it. In another class of cases we find one side of the septum straight, while the opposite nostril may be nearly occluded by a bony outgrowth along the lower portion of the septum, which gives it the appearance of being deflected. This, I think, is often due, as Dr. Bosworth has already pointed out, to exostosis along the line of the maxillary articulation, resulting from an injury during childhood, and producing at this point an arthritis. Reference has been made in this discussion to the use of the punch in the treatment of angular deflections of the septum. This is a method which I can not indorse, and which I consider very bad surgery. To remove the deformity in the septum by this method is a confession of our inability to correct it by better surgical means. The hole which is left in the septum by the punch forms a place for the collection of the secretions, which become dried into crust, and produce more or less irritation. At the point of angular deflections of the septum there is always more or less exostosis, which is thrown out as the result of the injury. This should be removed, which is best done by the nasal saw, before any attempt is made to correct the deflection.

The President: I wish to correct my record of 1882, at which time I expressed it as my belief that these changes in the position of the septum did not occur in early life, but that they made their appearance about

the age of puberty. Since that time I have had some experience leading me to modify that view. I recall two cases in which it became necessary to operate on children under two years and a half of age because the nostril was completely occluded by a deviated septum. The remarks of two of the gentlemen with reference to traumatism were very pertinent. I think that when the injury is not sufficient to fracture or dislocate the nasal bones, or to dislodge the cartilage, there is no probability that deformity will result. If the nasal bones are fractured, we can readily understand how the deformity results; if the cartilage is separated at either border, an inflammatory process will be set up which is very apt to increase its growth, and in that way cause deformity. But, if we bend the cartilage to one side or the other, it springs back as a sheet of steel would, and can not remain in the normal position.

Third Day—Afternoon Session.

Paper.

THE COMPARATIVE STUDY OF SOME OF THE METHODS OF TREATMENT BEST ADAPTED TO THE RELIEF OF OCCLUSION OF THE POSTERIOR NARES.

By ALEXANDER W. MacCOY, M. D.

THE object of this paper is to show the comparative value of the different means and appliances for the relief of partial or complete occlusion of the posterior nares caused by hypertrophy of the soft parts. The diminution of the openings of the posterior nares caused by encroachments of fibroid or other growths does not belong to the province of this paper. Occlusion of the posterior nares may arise (1) from hypertrophy of the posterior end of the lower and middle turbinated bodies (rarely of the *superior* turbinated bodies); (2) hypertrophy of the soft tissues over the *vomer*, familiarly known as hypertrophy of the vomer, and formerly called by some writers "œdematous infiltration of the vomer"; and (3) hypertrophy of the glandular tissue at the vault of the pharynx, known as the pharyngeal tonsil. This tissue, although outside of the posterior nares proper, is not infrequently the cause of occlusion in a greater or less degree when it becomes enlarged. Hypertrophy of the posterior portion of the lower turbinated bodies is by far the

most frequent condition met. The second in frequency is hypertrophy of the vomer. The third, hypertrophy of the posterior end of the *middle* turbinated body, is but little less frequently observed than the second. Hypertrophy of the pharyngeal tonsil is commonly observed in the young. It is not necessary in this paper to speak of the causes and effects of these conditions, as I have already treated of them in a former article,* but only to consider the surgical means for their relief. The treatment of these conditions by medicinal sprays, etc., but rarely effects any permanent good. Before the invention of the rhinoscope the naso-pharyngeal space was an almost unknown region, and the instruments were of necessity crude and illy adapted to the end. Contemporaneous with the new pathology of chronic rhinitis and its scientific study came suitable instruments, more delicate and precise. To Dr. Jarvis, of New York, is the world most indebted for the snare now so well known and for so long of such inestimable value. Cocaine, which, by lessening the pain, one would naturally suppose would widen the field for the use of Dr. Jarvis's snare, on the other hand, by its power to contract the erectile tissue, causes such a diminution as to make the encircling of the hypertrophied mass much more difficult, and, as these masses are most frequently composed of dilated blood channels (angiose hypertrophies), the effect is all the more marked. If the tissue in question belonged to the *true* hypertrophies, often present in the anterior portions of the nasal chambers, the objection would not be valid. In hypertrophy of the vomer the tissues, while not so susceptible to the contractile power of cocaine, are markedly difficult to reach, owing to their peculiarity in outline—being sessile—so rendering it almost impossible to encircle them in a wire loop. If the attempt is made to fix the loop of wire in the snare by the use of transfixion needles as strongly advocated by Dr. Jarvis, it is found to be extremely difficult, cumbersome, and often impossible. Hypertrophy of the outer end or face of the *middle* turbinated tissue can seldom be reached by Jarvis's snare with or without fixation needles. This portion of the posterior nares is well known to be the most difficult of access of all diseased parts in that region, and can only be effectually attacked from behind the soft palate and by different means. The *superior* turbinated tissue so rarely involved is inaccessible to any snare. The galvano-cautery, so well known, and, in skilled hands, so very valuable an adjunct to the successful measures

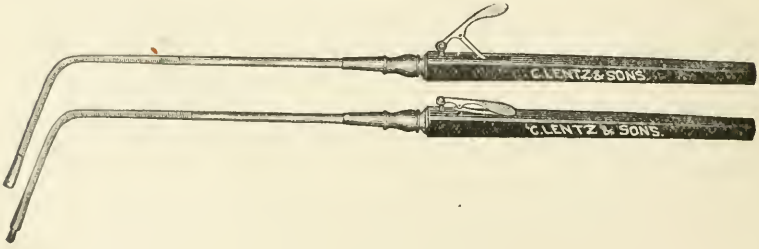
* "Observations on Occlusion of the Posterior Nares as a Result of Nasal Catarrh," "Medical News," April 7, 1883.

employed for the relief of hypertrophic catarrh, has many advocates and is largely to be credited with the grand average of success in the field of rhinal surgery. While an ardent admirer of the good points in galvano-cautery employed in this field, I am free to acknowledge, after an extended experience in its employment, that it has some minor objections, and has been greatly abused by some workers. With its employment in other regions of the nasal chambers than those mentioned in this paper we have nothing to do. The abuses in the post-nasal space are seen chiefly in transient, and sometimes permanent, damage to the orifices of the Eustachian tubes and to the structures of the middle ear. The cases of injury are few, it is true, in comparison with the whole number benefited, and if the galvano-cautery could always be employed in experienced and skilled hands, no ill effects could follow. The question of annoying bleeding after the free use of the heated electrode is sometimes raised as an objection; the lack of facility has been urged against the galvano-cautery, but unfairly if the electrodes are delicately made and flexible. The galvano-cautery handle should be very light in weight,* and have the binding posts in the middle and *not* at the end. After considering the arguments for and against its use I am persuaded that the galvano-cautery, combined with the use of cocaine, affords one of the most efficient means for the surgical relief of hypertrophic rhinitis. It differs widely in its value in the posterior nares from the Jarvis snare in that its field has been greatly enlarged since the nasal chambers have been anæsthetized by cocaine.

We now come to the last method of treatment of occlusion of the posterior nares—by chromic acid. This chemical has many friends and some bitter enemies; some who extol virtues in it which others deny that it possesses. It would be difficult to reconcile these diverse opinions unless we could find the true cause of the differences in the form in which the acid is used and in the manner of its employment. I think I can demonstrate that the objections offered by those denying its virtues arise from want of suitable appliances for the safe and exact application of the caustic, especially when directed to the posterior nares. The form of solution should never be employed in the posterior nares for caustic action, as it is impossible to make it exact, and, when dissolved, it loses much of its caustic power, besides giving rise to intense inflammation, which of course is to be avoided.

* Three quarters of an ounce.

The crystals are often employed, either loosely in contact with a roughened probe or rubbed on absorbent cotton twisted on a bent probe. This is faulty in that it is not controllable and is wanting in exactness, and is open to the general objection of always being liable to come in contact with the tissues of the soft palate and vault of the pharynx, either in the attempt to apply or during its withdrawal. Chromic acid, from the experience of the writer, should never be employed in the posterior nares in any other state than that of fusion, and it is requisite to its safe employment that a minute and well-shaped fused portion be used. This renders the acid fixed in quantity and less liable to spread to contiguous tissue. But, with all these precautions, unless the acid is protected by some means until brought into direct contact with the tissue to be destroyed, the soft palate and surrounding tissue will be smeared either before or after the application, and an inflammation thereby set up. It is almost impossible, even with a prior application of cocaine to the post-nasal space, to avoid coming in contact with surrounding tissue when the fused acid is not protected. In a certain class of cases, those with roomy post-nasal spaces, with the mirror to guide one, an exact application may be accomplished; but in a far larger number of cases, and in those generally most in need of such treatment, it is impossible to pass in the exposed bead of fused acid without injuring other parts. The confidence inspired by a safe and properly constructed instrument renders the act of the operator much more dexterous and exact. For several years I have had experience with such an instrument originally devised by me for the destruction of papilloma of the larynx and most admirably suited to that end. I diverted it from its first use to that of the destruction of hypertrophies in the posterior nares and vault of the pharynx. This instrument is already before the medical profession in the issue of the "Medical News" for November 7, 1885. The accompanying cut shows two views of the instrument.



The original paper above mentioned alleges the following advantages over other concealed applicators, viz.:

1. A double-acting lever movement.

2. Uncovering of the stylet by drawing the tube backward instead of pushing out the concealed stylet, and thereby avoiding the aberration at the point.

3. Flexibility of the stylet and tube, allowing a variety of positions and diversity of uses.

4. Self-recovery of the tube by a spring in the handle.

This little flexible instrument, if well constructed, is durable and precise. I find that by using it a once difficult and inexact application has now become precise and successful. Where the hypertrophied masses are large and of long standing it is necessary at times to repeat the application to get a complete and radical destruction of the tissue. The inflammatory reaction is wonderfully small—often not appreciable. Some increase of secretion necessarily follows for a few days. The facility and precision of the applicator are remarkable. This is readily apparent from the mechanism of the instrument. I have not considered other surgical means for these parts, because I consider those above mentioned by far the most desirable and prominent. In the treatment of enlargement of the pharyngeal tonsil the application of chromic acid to the mass is readily made with the same applicator. It is necessary to repeat the applications when the mass is large and diffused. The galvano-cautery point is very effective when pushed well into the growth and the current then allowed to flow. A white heat is necessary here for quick action and rapid destruction, as I have already shown it to be for the destruction of papilloma of the larynx.*

Discussion.

Dr. Jarvis: I can not agree with the reader in all respects. My transfixion needle, devised for the removal of turbinated hypertrophies, has not met with the favor which I think it should. I have employed it five or six years, and its utility has exceeded my most sanguine anticipation. The reason why the needles have not been more used is, I think, because they are not properly employed. I have myself gained efficiency in their use only after months of persistent practice. I depend upon the sense of touch almost entirely in transfixing redundant tissues. I would not exchange the needles for the galvano-cautery, chromic acid, or any other measure designed for the removal of turbinated tissues. They are, of course, always employed in conjunction with the wire-snare. I have also

* "Med. News," January 1, 1887.

noticed, as Dr. MacCoy has pointed out, that if, before attempting to snare a posterior turbinated hypertrophy, cocaine is applied, the attempt will prove a failure, the cocaine invariably causing contraction of the cavernous tissue. My rule is to first draw the wire around the hypertrophy, and then to apply the cocaine. I am surprised that the question of the unfailing utility of chromic acid should have been brought up, for it is now well known that this is not so harmless an agent as some proclaim it to be. I have seen it produce œdema of the fauces and severe turgescence of the turbinated tissues. A number of patients have been driven to my office by laryngologists simply because they had insisted upon using chromic acid, despite the knowledge of its baneful effects. By the use of the needles I can accomplish in a few seconds or a few minutes all that could be accomplished during weeks by chromic acid, and without the unpleasant results of the latter. It should not be forgotten that chromic acid has even set up dangerous erysipelas, and such a result is liable to follow the use of any caustic in the nose.

Dr. Rice: I think this one of the most important subjects which have been discussed during the session, for it concerns something which calls for treatment every day. I agree with Dr. MacCoy, and not with Dr. Jarvis. I have used the needles, but have finally given them up. The turbinated tissues are difficult to transfix, the operation is painful to the patient, and in many patients it is very difficult to apply the posterior loop because of the condition of the septum. Dr. Jarvis has not spoken of hæmorrhage, but one gentleman has recommended operating slowly to prevent this, while another tightens the wire rapidly, and then plugs the nostrils. Now, the danger of hæmorrhage I think is not great, but, at the same time, if the necessity for the patient going about two or three days with the nose plugged could be avoided, I think it would be an advantage. I have not seen the disadvantages of chromic acid spoken of by Dr. Jarvis, although I have used it often with most satisfactory results.

Dr. Donaldson: I agree entirely with Dr. Rice regarding chromic acid. Neither I nor Dr. Donaldson, Sr., have seen any trouble follow its use. I have not had favorable experience with the needles.

Dr. Delavan: I have studied the comparative merits of the snare, the galvano-cautery, and chromic acid for some time past, and find that patients, almost without exception, prefer the two former, and object to the acid on account of the pain and irritation which it excites, and which are apt to continue for a long while after the application is made. As to the danger of hæmorrhage after removal of posterior hypertrophies by the snare, I have never seen any which was not readily controlled.

Dr. Jarvis: To attempt to remove a posterior hypertrophy when the nostril is obstructed by a deformed septum is exceedingly poor surgery. The septal deformity should first be overcome. Moreover, I have never found it necessary to attack a turbinated body after removing a deflected septum; its turgescence will subside after nasal respiration has been restored.

Dr. MacCoy said that evidently the remarks of Dr. Jarvis concerning his (the speaker's) use of the needles could be applied to Dr. Jarvis's use of the chromic acid. The acid could not have been applied by him in the way the speaker had recommended. If it was applied from behind the palate without having it properly guarded, it was very likely to touch healthy tissues and do harm. Used in small amount, and put on with precision, it would cause scarcely any disturbance. It should be neutralized immediately after its application.

Paper.

RECURRENT NASO-PHARYNGEAL TUMOR. CURE BY ELECTROLYSIS.

By RUFUS P. LINCOLN, M. D.

IN April, 1886, I saw, in consultation with Dr. Satterthwaite, A. B., aged nineteen years, who feared a recurrence of a naso-pharyngeal tumor that had already been twice removed by a surgeon in San Francisco, Cal. I expected to have received before this time a report of his operations and of the pathological character of the tumors removed, but it has not yet come to hand.

Briefly, from the patient's account, I will state that the principal growth was removed from behind the palate in March, 1885, and a tumor that presented in the left cheek from under the zygomatic arch the following September. The tumor reappeared in the posterior nares, and the first operation was repeated in November. At the time of the first operation the patient could not breathe through either nostril; the soft palate was distended, and the tumor could be seen when looking into the mouth. The patient was deaf in both ears. The left cheek was enlarged by a growth, which he was informed was a part of that in the throat. The patient was conscious of the presence of the tumor two years before the first operation.

When I first saw him he complained of inability to breathe through his left nostril, and of a sense of fullness in the posterior nares. To inspection there was nothing abnormal visible in either nostril anteriorly. A probe passed into the left, however, met an obstruction as it reached its posterior border; the right was entirely free. On looking into the mouth, the left side of the arch of the soft palate was gaping; it evidently had been once incised and only partially restored. Posterior rhinoscopy disclosed a pinkish-colored mass, of about the size and shape of a horse-chestnut, nearly filling the left half of the post-nasal space. A further examination showed this to be an outgrowth from the left border of the vault and the left lateral wall of the naso-pharynx. To the finger it was immovable, but elastic.

On the left side, above the first molar, where the mucous membrane is reflected upon the inside of the cheek, a sinus presented, from which a small amount of purulent matter was escaping. A probe introduced here penetrated two inches and a half.

It was through an opening made at this point that the zygomatic prolongation of the tumor was removed.

It was decided at our consultation that an attempt should be made to destroy the tumor by electrolysis. Mr. W. F. Ford prepared for me some needles insulated to within three fourths of an inch of their points, and of a convenient length, to be used through the anterior nares.

June 3, 1886.—I did my first operation as follows: I introduced two needles well into the tumor, and connected them with the negative pole of the battery. The positive pole was always subdivided, terminating in two large sponge-covered electrodes, one of which was firmly held against the chest below the left clavicle, while the other was in a like manner placed just above the corresponding scapula. After the first treatment but one needle was used. There were in all sixteen applications at intervals of from four to six days, each *séance* occupying from twelve to twenty minutes.

July 29th.—All evidence of a tumor had disappeared, the only trace of the growth being a button of cicatricial tissue, which occupied its former site.

The battery used was that made by the Galvano-Faradic Company, and the number of cells employed at each *séance* was quickly increased to sixteen, and sometimes to twenty-two. The immediate effect of the electrolysis was a distension of the mass operated upon, and a change of color toward lividity, but both of these changes passed away within twenty-four hours. At each succeeding *séance* the mass was decidedly smaller than at the previous sitting. The only disagreeable symptom incident to the operation beside slight pain was a feeling of dizziness; this never lasted more than half an hour after the operation ended. The patient has been frequently seen since the date last mentioned. There has never been any evidence of a disposition of the tumor to be reproduced. All disagreeable symptoms attributable to the growth have vanished.

My excuse for presenting this subject to you to-day is to emphasize and justify what I have twice before insisted upon at meetings of this association—viz., the ability to successfully treat certain cases of naso-pharyngeal tumors by galvano-cauterization and electrolysis.

Discussion.

Dr. Delavan: I had the pleasure of seeing on two occasions the patient whose case has just been related. When I saw him during the latter part of July, 1886, the growth had been absorbed to such an extent that

its site alone was demonstrable. As to the treatment pursued by Dr. Lincoln, it seems unfortunate to me that the merits of this method, as well as those of the operation by means of the galvano-cautery, so brilliantly and incontestably established both in this country and in Europe, should be persistently denied by many general surgeons. It has been my privilege during the last fifteen years to witness a considerable number of operations for the removal of retro-pharyngeal tumors by the more severe surgical procedures, and from what I know of them I am forced to believe that many unsuccessful results have been allowed to go unrecorded. In other words, I think it more than probable that the actual rate of mortality has been higher than would appear from the published records.

Dr. Langmaid: It seems to me this is a most interesting case. I do not know how often this operation has been done, but everybody familiar with these tumors knows how destructive they are, and how necessary it is to remove them, and, when they are removed by the snare, galvano-cautery, or section of the bones of the face, how frequently they return.

Dr. Glasgow and Dr. Cohen thought the excellent results of the treatment of these naso-pharyngeal growths by electrolysis obtained by Dr. Lincoln, and the dangers attending the cutting operation, spoke highly in favor of giving the former method a more extensive trial.

Dr. Hooper referred to the case of a boy who had a malignant form of myxo-sarcoma in the naso-pharyngeal space, which had been removed with both the hot and the cold snare, but which had recurred repeatedly, notwithstanding the attempts to keep it down by all known measures excepting electrolysis.

Dr. Cohen further said that he thought the great advantage of the treatment by electrolysis was the fact that an open wound was avoided, and consequently there was asepsis, and in addition thereto absorption of the whole tumor was brought about; therefore the electrolytic was far preferable to the galvano-cautery method of treatment.

Dr. Lincoln replied to Dr. Cohen that the reason why he used but one needle after the first treatment was that the tumor had shriveled considerably, and he thought the influence would extend sufficiently far from the one point. He was in grave doubts as to how much of the result from this treatment should be attributed to electrolysis and how much to cauterization. It was on the border between cauterization and electrolysis. The chemical action diminished rapidly as we receded from the needle. A slight groove was left after the disappearance of the tumor, showing that there seemed to have been complete absorption of it. The influence of the current in this treatment was far-reaching, and was not limited to the tissues with which the wire or electrode came immediately in contact. It extended to the nerves and blood-vessels, producing obliteration far beyond the point of contact.

Paper.

TWO UNIQUE CASES OF CONGENITAL OCCLUSION OF THE ANTERIOR NARES.

By WILLIAM CHAPMAN JARVIS, M. D.

COMPLETE congenital stenosis of the anterior nasal orifices of the nature I am about to describe must evidently be viewed as an extremely rare condition, inasmuch as, after a careful and conscientious search, I have been unable to find a single case reported in the medical literature of the subject, and the two reported in this paper were the only ones discovered among more than ten thousand patients recorded at my university and Bellevue Hospital clinics, and in private practice. This observation and the fact that I am able to present a case of imperforate nostrils successfully treated by means of my nasal drills and an electric motor, re-enforced by an invitation from our esteemed president to read a paper before this association, are the principal motives which have induced me to infringe upon your valuable time.

The first case to which I shall invite your attention is that of a young man, eighteen years of age, who, though unprepossessing in appearance, showed a fair state of physical development.

He first consulted me in September, 1885, in search of relief from a life-long closure of both nostrils. The gentleman to whom I was indebted for this most interesting case stated that his attention was particularly attracted to the patient's condition by reason of an unfavorable prognosis pronounced in his hearing by a well-known surgeon, which was substantially that the condition of the young man's nose was irremediable, and that he had better submit to the annoying, though not serious, discomfort rather than undergo an operation the successful issue of which was involved in much doubt, a view which appeared quite plausible on making a superficial examination.

On ordinary inspection, the dark outlines of the anterior nasal orifices were seen to be replaced by two cup-shaped depressions about four millimetres in depth. This barrier consisted of a dense, white, glistening membranous wall, fringing the inner face of the alæ nasi, and fusing with the side of the septum lying opposite. The center of the cup-shaped depression in the right nostril was perfectly *smooth*, not being marked by so much as a wrinkle. A close inspection of the left anterior nasal orifice (Fig. 1) revealed the presence of a diminutive opening, *a*, at its upper portion, capable of accommodating with difficulty the point of a fine probe.

The external nose was large and well developed, excepting an insignificant transverse crease on the right side. An interesting feature was the striking enlargement of both the upper and lower lips. This peculiarity would appear to afford corroborative evidence of the accuracy of Ziem's view that labial hypertrophy might be present as a result of permanent nasal stenosis. The practice of posterior rhinoscopy was rendered quite difficult, but I finally succeeded in obtaining a satisfactory detailed sketch of both posterior nares.

The vault of the pharynx appeared perfectly free. Each post-nasal opening was distinctly visible; the right one, however, was seen to be imperforate at a point beginning about three eighths of an inch from the free edge of the vomer. The cause of this occlusion was, furthermore, distinctly visible as an extreme deflection of the vomer to the right, even to the point of contact with the opposite nasal wall.

The amplitude of the left choana was naturally increased at the expense of the right post-nasal opening, and it was possible to make out the left inferior turbinated body, although it appeared smaller than usual.

This brief outline will convey a general idea of the anterior and posterior rhinoscopic appearances.

In addition to the patient's personal record of a life-long discomfort from complete stoppage of the nostrils, I was fortunately able to obtain a detailed biography of the individual from the time of his birth.

This information was drawn from the young man's mother, and it might be added to her credit that she proved to be an intelligent and painstaking observer.

I have extracted the following brief notes from the *body* of her narrative, as constituting important evidence of the congenital character of the deformity: About six weeks after the birth of the child her attention was attracted to the infant's nostrils by a slight discharge. Shortly after making this observation she also observed that the child breathed with great difficulty through the nose. She directed the attention of her physician to the nasal difficulty, and, in accordance with his instructions, essayed to syringe the nostril, but her effort in this direction proved futile, for the reason that the fluid immediately rebounded on being projected into the nostrils. Snuff was then prescribed, but it was found impossible to sneeze away the obstruction. During the first year of the child's life she remembers having seen the pin-hole perforation already referred to as occupying the left nostril of the young man. From the moment she first noticed the obstruction in breathing, during the infancy of her boy up to the time of her application to me for relief, her son had never drawn a breath through the nostrils. The misery produced by this condition has proved the burden of her life. Ever and anon has she been aroused from her slumbers by the suffocative sounds made by her son struggling in his sleep for more air.

During these paroxysms the boy's tongue appeared to fall backward into the throat and so block up the only available avenue for the entrance

of air into the lungs. It required violent shaking to arouse him from the stupor which accompanied these attacks, which, like similar manifestations observed in children suffering from the obstructive effects of enlarged tonsils, might be attributed to the carbonization of the blood resulting from deficient aeration of the inspired air.

As bearing upon the possibly scrofulous character of this anomalous condition of the nostril, the following notes, given to me by the mother concerning her son's state of health and that of her several children, may prove of interest. Mrs. F. recollects having suffered during her childhood with a nasal difficulty. The present condition of her nostril clearly demonstrates the pre-existence of either scrofulous or syphilitic disease. The external nose is in a state of collapse, a deep furrow running transversely across the dorsum at the level of the nasal bone. The tip of the nose is tilted upward, and anterior rhinoscopic examination demonstrated the almost entire disappearance of the cartilage of the septum, along with a considerable portion of the vomer and plate of the ethmoid bone. Both nasal cavities are abnormally spacious. She has borne seven children in all. Her first child had been subject to attacks of nose-bleed. One day, while at play, a ball accidentally crushed his nostril, provoking a profuse and persistent hæmorrhage, which only ceased with the child's life. The attending physician attributed the fatal result to a ruptured blood-vessel. Another son was subject to severe headaches, which were often accompanied by nose-bleed. He is now fifteen years old and a victim of catarrh. Only three of her children apparently possessed good health.

Diagnostic Conclusions.—Basing my deductions upon the foregoing history and appearances, I would offer the following explanation to account for the origin of this remarkable nasal anomaly: The individual was probably, in the first place, born with a malformed nostril, the evidence of which exists in the form of the misplaced vomer, which could not assume its faulty position either from injury or disease. The right nostril was probably occluded anteriorly by a membranous wall at birth; the left nostril, perfectly free posteriorly, communicated, by means of a small orifice in the anterior nares, with the outside world. Possibly this was cicatricial.

A scrofulous coryza, occurring at or shortly after birth, was the probable cause for the discovery of the catarrhal flux and subsequent stoppage of the nasal passage. Contraction of this small orifice of escape evidently rapidly occurred until it was reduced to a mere pinhole perforation.

The surgical treatment adopted for the correction of the condition just described was commenced on April 26, 1886, the first operation being performed at the University Medical College, before the students. A perforating drill having a quadrilateral cutting face, the four knives being

arranged at right angles to each other, was employed to make the preliminary puncture through the dense fibrous membrane. This drill was propelled by an original modification of the common surgical engine. Weber's drill chuck was employed. The right cup-shaped depression having been sprayed with a strong solution of cocaine, the perforating drill, revolving at full speed, was directed against the obstruction, through which it easily made its way, reaching the free space in the deeper portion of the nostril. The instrument being then withdrawn, my rasp drill was introduced within the preliminary opening, which it promptly and freely enlarged laterally. At the conclusion of the cutting, rhinometric measurements showed the transverse diameter of the newly made nasal orifice to be just four millimetres, and the vertical measurement six millimetres. The slight hæmorrhage which followed the practice of this procedure was readily controlled by means of a pledget of cotton and did not inconveniently impede the progress of the operation. A free rush of air through the new nasal orifice convinced us of the success of the operation. The edges of the incised obstructing membrane appeared to be about two millimetres in thickness. On a subsequent occasion the right nostril was laid open by a repetition of the above procedure, with slight modifications. My patient, who had been formerly dismissed as cured, called upon me again in April, 1887. An examination of his nostril showed that, whereas the left anterior naris had remained patent, the other nostril had contracted to the size of a useless slit. He had realized so much comfort, however, from the use of his free nostril that he felt impelled to seek re-

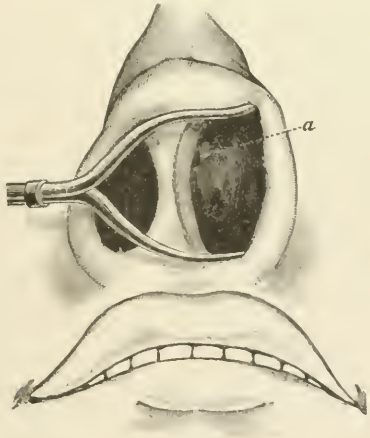


Fig. 1.

lief through another operation for the restoration of the right nostril. In reopening this nostril, I cut more freely with my drills than previously,

removing the dense fibrous tissue up to the point of its attachment to the osseous walls of the nose. To insure perfect success, I took advantage of the opportunity and enlarged the already patent nostril to the extent of several millimetres.

These sketches, taken from life, will enable you to appreciate the appearance of the nostrils before and after the performance of the several operations practiced for the relief of this unique and distressing malformation.

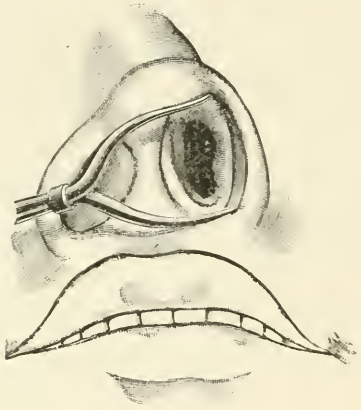


Fig. 2.

Electricity was utilized to obtain the motive force for propelling the drill during the second operation. The motor employed by me is known as the C and C motor. Different from the instruments of this kind usually found in the market, the C and C motor is supplied from a single quantity cell or from any ordinary galvano-cautery battery. The armature, which connects directly with the drill, revolves between fifteen hundred and two thousand times a minute. The motor and flexible shaft are manipulated while suspended in mid-air. The motions of the armatures are concealed by means of a metallic shell, which does away with the terrifying effects excited by the sight of the rapidly revolving axles.

By means of an adjustable connecting-rod I am enabled to attach the flexible cable to either side of the armature. It is obvious that this device permits me to use either right or left cutting drills. The force exerted by the motor is estimated as high as one eighth horse power.

I also take this opportunity to present two other forms of my

tubular drills, which I have termed, respectively, a spiral and interrupted spiral. They are better adapted for cutting through soft tissues than my tubular rasp drill.

The next case to which I shall direct your attention is that of a young woman, aged sixteen, who was brought to me by her stepmother in 1884 on account of an almost absolute stoppage of both nostrils.

As in the case just reported, the nose of this patient possessed neither respiratory nor olfactory value. The girl had been able at times to forcibly expel a little air through the nose. Despite the fact that the patient had never, within the memory of the mother, been able to use the nostrils, there was no deafness. The good hearing possessed by both of these patients would seem to disprove the accuracy of Toynbee's and Lucae's views concerning the injurious tension exercised upon the drum heads during deglutition in individuals afflicted with nasal stenosis. The general health of the patient was poor. Her intellectuality, I believe, would be placed considerably below that possessed by young women of the same age. Whether this was due to the faulty conformation of her skull or was simply the natural intellectual dullness sometimes observed in individuals afflicted with long-standing nasal stenosis, or both, was an interesting though unimportant question.

Examination.—The first thing particularly noticeable about the young woman was the remarkable expression of her face. This peculiarity resulted from a variety of facial irregularities, conspicuous among which I might mention a flat, retreating forehead, an unusually broad interocular space, and the existence of two extraordinary prominences of the malar bones near each inner canthus. Add to this a drooping lower jaw, and you have a pen-picture of the unsightly physiognomy inherited by this unfortunate girl.

An examination of the anterior nares revealed the cause of the nasal stenosis in the shape of two pale-pink protuberances which appeared to completely block up each inferior meatus. The columna of the septal structures was intact, and no portion appeared to be involved in the deformity. My first impression that the two obstructing bodies were extensive turbinated hypertrophies was quickly dispelled upon touching them with a probe. In reality, they were composed of bone, which I afterward discovered was exceedingly dense in consistence. The mucous membrane covering the structures was exceedingly thin. These bodies impinged directly against either side of the septum, and it was found impossible to introduce a probe through the narrow crevice found at the point of contact.

An examination of the naso-pharynx revealed the presence of nothing abnormal in character, and the posterior nares appeared to be spacious and well shaped. Basing my deductions upon the gross appearances

just given, and the structural conditions revealed while operating, I felt justified in regarding the formation as a congenital abnormity of the principal bones of the face associated with marked malformation of portions of the anterior nasal framework, especially the inferior turbinated bones.

The bony structure of the turbinated bodies possessed more the character of an eburnation than the common osseous shell. Its density was so great that the points of the rongeur forceps frequently clashed together without cutting the bone, although I had succeeded with the same instrument in readily removing ordinary turbinated osseous tissue. These constituted the principal peculiarities of this unusual deformity.

Inasmuch as my surgical efforts did not yield the satisfactory results hoped for, I will not detain you with the details of the operation undertaken for the relief of the patient. It might be worth stating that while she was under the influence of chloroform a channel was cut through the patient's nostril as far as the naso-pharynx, my rongeur forceps being employed for the purpose. The immediate good result—restoration of nasal respiration—proved delusive, inasmuch as the contraction which followed the healing process soon robbed us of the respiratory space we had acquired. Although my proposition to repeat the procedure was not received with favor, I am nevertheless confident that the employment of the electric drill in conjunction with intra-nasal dilators would have been followed by excellent results.

In concluding my remarks, I desire to notice the general significance of congenital occlusion of the nasal passages. This form of nasal stenosis is always referred to as an extremely rare condition. References on the subject are almost exclusively applied to abnormities situated in the choanæ; or, in other words, in the most obscure and inaccessible portions of the nasal cavities. The majority of these cases were reported as imperforate, the obstruction having the form of a bony plate, which spread like a web over one or both post-nasal orifices, and was directly continuous with the palate bone, of which it formed an integral part. Such a deformity, though demonstrated by a post-mortem examination to be possible, must nevertheless be viewed as almost unique in its occurrence. Though thoroughly convinced of the perfect sincerity of those who have from time to time reported cases of congenital occlusion, I feel, nevertheless, constrained to doubt the accuracy of their conscientious diagnoses.

Furthermore, I may add that I think any one is justified in taking exception to my own or any rhinoscopic diagnosis based upon an examination conducted by means of the finger in place of the mirror.

Twenty recorded cases of congenital closure of the posterior nares in otherwise normal noses, many of which were double-sided, and not one of complete bilateral congenital occlusion of the anterior nares, is a disproportion that might well provoke surprise, or even incredulity. An inquiry concerning the unequal existence of these two conditions is most desirable. As one explanation, the strong probability of deflection of the vomer being mistaken for the plates of Luschka might be safely advanced. Congenital deflection of the vomer is a very common intra-nasal deformity. I have seen the misplaced vomer deflected to the point of contact with the lateral nasal wall. It requires no stretch of the imagination to picture an investigator, whose mind has been preoccupied with the idea of the existence of transverse congenital plates, thrusting his finger against an extreme deflection of the vomer and ratifying this preconceived impression. I consider a diagnosis of congenital transverse osseous plates or membranous occlusion of the choanæ, based upon digital exploration or the use of the probe, little better than mere guess-work. A careful and successful rhinoscopic examination should constitute the only criterion for the formation of such an important diagnosis.

Congenital deflection of the osseous septum has been shown to be an exceedingly common deformity, and therefore requires no especial mention in this connection. I have already considered its hereditary and pathological significance in a paper devoted to the ætiological relations between the malformed septum and pulmonary disease. The septum of heredity is almost invariably associated with an elevation of the roof of the mouth, which can often be traced back to a parental origin.

Finally, in order to indicate the scope of my unsuccessful search for the record of instances of congenital occlusion similar to those just described by me, I might mention the discovery of an interesting case of unilateral anterior stenosis in a cadaver dissected by Delstanche, which proved to be the nearest approach to my own. The left nostril was reported to be intact. The right nostril was imperforate, the alæ nasi being absent. Delstanche states that the condition was either congenital or acquired, and he favored the view of its being an inherited condition. It is to be regretted that the most important testimony in this case, the life-history of the individual, could not be obtained.

Instances of acquired stenosis of the nasal passages are exceedingly common, and therefore possess no particular interest for us in this connection. As is well known, they may result from adhe-

sions incident to injuries, ulcerative processes, and abrasions of the septum.

The cicatricial adherence of the septum to the turbinated tissues is a common condition, and often occurs as the result of the free and careless use of caustics, the galvano-cautery, and unskillful operative attempts to remedy the deflected septum. These forms of acquired atresia are merely mentioned to render the presentation of the subject more complete, and to show that they have been properly excluded from the category of congenital occlusions of the anterior nares.

Paper.

THE IMPORTANCE OF LOCAL TREATMENT IN DIPHTHERIA.

By WILLIAM PORTER, M. D.

IT is not needed that mention should be made in this association of the wide prevalence of diphtheria or of the great fatality attending it. Neither would I be thought to assert that local treatment is the most important part in the conduct of this dread disease. Surely it were better to entirely lose sight of local requirements than to be lacking in that care and alertness needed in the successful general medication of each case.

The thought I would present here is that efficient local treatment is always indicated in the early stages of the disease, and often of avail in the more advanced complications. It is to be regretted that the physician is not called sooner in many instances. Often not until the system is profoundly impressed by the diphtheritic virus is he summoned, and then asked to combat, not an incipient fire, but a conflagration rapid in its advance and destructive in its tendency.

First of all, I believe that diphtheria is in its attack a local disease, most prone to invade a mucous membrane denuded of its epithelium. How the specific poison first finds a foothold we know not, but probably a direct contact is quickly followed by growth and absorption. As in the well-known phenomena attending successful vaccination, the systemic infection is quickly followed by increased local disturbance and exudation, most likely at the point of the primary infection. This new development, the false membrane, in its turn becomes a distributing center for all parts of the system.

If it were possible to antagonize the attack at the beginning, when

the diphtheritic impression is first received, the problem of cure would be easily solved. And here let me say parenthetically that I believe it is good practice to use, frequently and thoroughly, astringent and antiseptic sprays and applications with children who may not show evidence of diphtheria, but who are or have been exposed to it by living in the same house, or are in any known way in the line of invasion. Just as an intact mucous membrane completely covered by epithelial scales may be securely protected from attack, so I hold that, in cases where a denuded membrane offers an invitation for the ready reception of the diphtheritic germ, we may afford an artificial protection, or by proper means destroy an already present foe.

Yet it is not of prophylaxis that this essay is to treat, but of efficient conduct in cases where the disease is present. These conditions exist: 1, a local specific inflammation; 2, a general septic condition, at first caused by, and afterward aided by, absorption from this local inflammation.

While many eminent practitioners depend upon general medication, and some have quite abandoned all forms of local treatment, it is evident that all indications are not met unless attention is given to the local manifestations of diphtheria. If the disease is of local origin, if the systemic infection is constantly receiving fresh reenforcement by means of the ready absorption of the specific poison —aid the system by all means to throw off the incubus of infection, but also limit if possible the further supply.

How shall this best be done? This depends upon the amount of local progress. I do not hesitate to say that I have seen a local diphtheritic exudation melt away in three or four days under proper local applications, the system being at the same time well guarded. But were these true cases of diphtheria? This much in affirmation: Several of these of which I speak were in families where one child had just died from diphtheria, where the symptoms were all indicative of diphtheria, and where there had been every opportunity for infection.

An old cry is that a physician who professes to conduct his cases of diphtheria to a favorable termination is an alarmist, and his cases are simply follicular amygdalitis. Such a pitiable antagonism is unworthy a scientist. Mistakes do occur, and it is better they should be on the safe side; but I am willing to call a case diphtheria where I find that the child, having been exposed to the contagium, has anywhere upon the mucous membrane of the upper passages a thick, continuous yellow exudation, closely adherent to the mucous mem-

brane, with a tendency to necrosis and sloughing, especially if the pulse is quick and weak and the temperature above normal. It is possible that such a case is not diphtheritic, but it is not probable, and we deal with probabilities. The differences in local appearance and general condition between a follicular exudation and the characteristic false membrane of diphtheria are usually so marked that the physician need not be mistaken, and if he does err, let him give the child the benefit of the doubt.

Beyond this class we have another or advanced degree of the same class in which there can be no doubt as to the type of disease We find it when called two or three days after the first attack. No longer is there now a small patch confined to the tonsil, or to a small part of the pharyngeal wall or soft palate. The natural guardians of the child have slept and the insidious enemy is in full possession. A dense dirty-yellow and sometimes disintegrating exudation is found closely attached to the natural tissues in some places, and in others hanging in loose shreds, while the naso-pharynx is filled with detached portions of membrane, retained mucus, and sometimes blood, and poison from this septic hot-bed is being rapidly absorbed and carried to the most remote parts of the little frame. Each of these classes of cases demands special and distinct local management.

Let us consider the first class, where the membrane is yet small in extent and of recent formation. Can we close the portals of the absorbents and render the existing local focus of disease inert? After experimenting with many formulæ, I have for several years renewed my confidence in the mixture of equal parts of glycerin and tincture of chloride of iron. The more fashionable and really excellent practice of using bichloride of mercury provides for antisepsis, but not for the equally important matter of astringency. But little manipulation is needed in these early cases. A cotton-covered probe is by far the best instrument, and with it the solution is not merely brushed over, but pressed against, the point of attack. There is no necessity of hurting the child if care is taken, but, on the other hand, I retain a vivid picture of the good old doctor, conscientiously bound to do something, his spectacles awry, plunging a "swab" at random down the throat of a kicking child, or through the clinched teeth, scraping the mucous membrane from the roof of the mouth by the good help of the ubiquitous tablespoon. By proper tact the application may be made easily, and, if it is repeated frequently—*i. e.*, every two hours—its efficiency will soon be demonstrated.

In the more advanced class of cases much more than this is

needed. The extent of false membrane is greater, it is more difficult to reach, and the upper respiratory passages are obstructed. First, all of the detached membrane and *débris* should be removed by the syringe, and there is no better method of doing this than that described by Dr. Jacobi in the discussion following Dr. Billington's able paper on "Local Treatment in Diphtheria" ("Medical Record," April 9, 1887). A tepid but weak solution of common salt is an effective cleansing agent, after which a spray of bichloride-of-mercury solution can be used. The spray should be used warm, and to protect the nostril I often pass over the end of the spray-tubes a small piece of rubber-tubing and roll it up, so as to fit the nostril fairly well. There is no use in attempting to employ the more direct and potent applications by means of the probe in these cases. Many other agents have been used by spray and inhalation or insufflation, such as carbolic acid, lime-water, weak solutions of iron, etc. These are useful, but time forbids speaking of all.

When there is great irritation from laryngeal involvement—if the exudation is not too great—the vapor from slaking lime often gives relief.

I should greatly exceed my limit of time did I attempt to discuss the relative value of tracheotomy and intubation. The opportunity is given, however, to call attention again to what I believe to be an important addition to the ordinary procedure in tracheotomy—*i. e.*, to fill the larynx above the artificial opening with a pledget of cotton or small sponge saturated with an antiseptic solution, to prevent, if possible, the extent of the local disease by continuity of surface.

Let me repeat these thoughts: 1. Diphtheria is in its incipiency a local disease. 2. Local treatment is important, an aid to, but never a substitute for, the careful general medication and care. 3. The exact means used in local treatment may not be important, but the end to be accomplished is the speedy sterilizing and disintegration of the diphtheritic exudation, without injury to the adjacent tissues. 4. The local treatment must be conducted promptly, persistently, and carefully.

Paper.

CONSTITUTIONAL CAUSES OF THROAT AFFECTIONS.

By S. W. LANGMAID, M. D.

I THINK you will all agree with me that, outside of the consideration of certain nervous phenomena, hardly anything has been said in these meetings upon the subject of constitutional causes of morbid appearances in the throat and abnormal phenomena of sensation and function. That such causes have not escaped your notice I am well aware, since successful treatment is otherwise impossible. This short paper, then, is in no wise an exhaustive treatise, but is to be considered as simply suggestive of a large field for investigation and discovery.

While I would not be understood as undervaluing the minute and systematic description of morbid appearances and functional peculiarities of the upper respiratory tract, I would suggest that a most interesting and important lesson to be learned from such observation and description is, that all that is morbid in this region has underlying causes which *may* be external to the body but may be *intrinsic*, and the exhibition of natural or acquired idiosyncrasies of the individual.

An exhaustive discussion of such constitutional conditions means the consideration of all that is known of medicine and its kindred sciences; to be satisfied with less in the practice of our profession means deliberate intellectual suicide and gross injustice to our patients. That the members of this society are free from the stigma which is sometimes ignorantly applied to those who practice specially, the original and exhaustively learned papers which make up our archives bear witness.

It has sometimes seemed to me that our attention has been too commonly fixed upon the local morbid phenomena of diseased throats, and, again, that we are prone to consider climatic conditions as causes rather than factors in the production of such disease.

That atmospheric conditions do affect the respiratory mucous membrane no one doubts, but why such atmospheric conditions are operative at one time in the same individual, and innoxious at another time, is well worth our consideration.

That a pharyngitis may be the tell-tale of a poisoned or morbid condition of the general system is evident when we think for a

moment of the pharyngeal exhibition of acute diseases, of scarlatina, of measles, of typhoid fever, of syphilis, of phthisis, of sewer-gas poisoning.

Who can deny that morbid conditions of the system which, although as yet not well understood, are known in some way to be due to wrong functioning in the chylopoietic system, may be the *fons et origo* of many intractable faucial inflammations? That such is the case, I have enough evidence to direct successful treatment. The congested, excessively irritable pharynx of alcoholism is so well marked as to make a diagnosis unquestionable. Indeed, the hereditary succession of a son of one of the partners in a large mercantile house was prevented by my obstinate refusal to consider the condition of the throat as the result of anything but the daily ingestion of large amounts of alcohol, the truth of such belief on my part being in a few months placed beyond question by the appearance of abdominal ascites and general paralysis.

We must look further than the laryngoscope will enable us to see if we would rightly comprehend the causes of the congested nasopharynx of the young adolescent. We must consider in young persons how much the process of the second dentition has to do with the stimulation of neighboring parts.

The enlarged submaxillary or cervical glands do not always indicate a scrofulous diathesis; at any rate, the abstraction of the decayed molar will frequently result in the disappearance of the obtrusive glands. And so it is with the enlarged tonsil; the cause of the enlargement will frequently be found in the widespread irritation set up in the process of dentition, and unless the respiration is seriously interfered with the surgical remedy need not be hastily undertaken.

I think I shall voice the experience of many when I say that one of the most intractable diseases which we are called upon to treat is chronic recurring coryza. In many cases the treatment first advocated by our own members—the destruction of the supersensitive areas in the nasal chambers, or the removal of obstructing erectile tissue—seems to constitute a cure, but in other cases no allowable destruction of the mucous membrane or underlying structures seems to more than modify the severity of the seizures and the frequency of their occurrence.

In such cases we must look beyond the mucous membrane, and we shall find that a disordered emotional temperament is at the bottom of the trouble, and, unless the treatment takes in all the

circumstances of the life of such a sufferer, very little relief may be expected.

Those nasal or pharyngeal reflex propagating centers will sometimes become singularly dormant during banishment from a luxurious but care-inflicting home to a dusty, drought-seared prairie or amid tropical vegetation, but, in spite of cauterization by hot iron or chemical caustic, will quickly spring into activity as soon as the wanderer regains his former surroundings.

Let him who has tried to banish with sprays and pencilings the long-existing sensation of a "lump in the throat, which rises and threatens to choke" his patient, try the exorcising power of a dose of castor-oil, and he will be surprised to learn that an overloaded colon has been trying to tell its story as stories are told—by the throat. How often will the paroxysmal cough be banished by the same procedure!

In my experience the magic effect of quinine upon an inflamed throat has been clearly shown in a few cases of former residents of a malarious climate, exhibited, I must confess, as a *dernier ressort* when local applications had failed.

The familiar designation of one form of pharyngitis would seem to imply that Nature herself set the limit to unrestrained sermonizing. "Clergyman's sore throat" exists to-day and teaches its lesson to those of us who study it, although it has long ceased to masquerade in our nomenclature in clerical habiliments.

It is a pharyngitis with the descriptive prefix *follicular*, viz., long continued, chronic. But such a pharyngitis is not peculiar to the sacred teacher. Its origin is not by any means in the necessary use of the voice. The sedentary, studious life, with resulting disordered digestion, together with other conditions inseparable from the profession of the priest, are quite enough to produce a throat affection which has been considered peculiar to clergymen.

I should weary your patience by calling attention to many more forms of throat diseases whose origin is well known to be intrinsic—that is, constitutional. But I may be allowed to refer to just one other well-marked cause of some of the most distressing throat affections—I mean the rheumatic and gouty manifestations.

Many of the older writers considered that acute amygdalitis had a rheumatic origin, and the old treatment by guaiacum has its modern adherents. That the quickest method of relieving the suffering of an acute pharyngitis, tonsilar or otherwise, is through antirrheumatic remedies I have good reason to believe.

So many cases of spasm of the glottis in gouty subjects have come to my notice that I have in two instances lately predicted that, sooner or later, spasm would occur—with unexpectedly speedy verification.

The temptation to enlarge upon the subject of this paper is almost irresistible, but I shall content myself with a final word.

Local treatment is in the nature of *repair;* the constitutional and hygienic treatment must be in the direction of renewal of normal processes. The swollen and congested mucous membrane, the hypertrophied tonsils, the elongated uvula, and the prominent follicles must be regarded as symptoms only. The pain and discomfort, the spasm of the glottis, or the recurring vocal disability will not be banished for any length of time unless the underlying constitutional abnormity is removed.

Discussion.

Dr. Glasgow: The constitutional nature of many pathological conditions of the throat is too often ignored in the great prominence given to the local lesions. The sentiment expressed by an absent colleague, who says "the laryngologist of the future must be more the rhinologist, and the rhinologist be more the surgeon than the physician," is, in my opinion, a false sentiment. It encourages the tendency of the times to an exaggerated consideration of the local lesions, and does not give due consideration to the underlying causes, which are often strictly constitutional. I believe that such views may do harm to the true growth of laryngology. I believe there is even at the present time too much surgical interference, and I believe a more conservative course to be the true one. I agree with Dr. Langmaid in considering many of the diseases of the throat to be of constitutional origin, depending on the various diathetic conditions. The favorable action of the emetics related by Dr. Cohen shows the dependence of the laryngeal condition on a disordered condition of the digestive organs, and I believe that a more thorough consideration of possible constitutional causes will lead to a more satisfactory knowledge of diseases of the throat.

Dr. J. Solis-Cohen: There is one point which I should like to make with regard to the condition known as rheumatic sore throat. I have had my doubts at times whether the term rheumatic was correct or not. Affections which we call rheumatic are sometimes caused, as I have frequently seen, by local applications of the galvano cautery to the pharynx and to the tonsils. That is to say, I have frequently had patients complain of pain in the trapezius muscle, for instance, from cauterization of the pharynx or the tonsil. Sometimes there will be torticollis. Sometimes they complain of pain in the ear. I have found the treatment by guaiac just as serviceable in these instances as in

the treatment of amygdalitis, the result, as we suppose, of exposure to cold. Whether the cause is a nervous influence or not, I can not tell. As you all know, the spinal accessory nerve divides into two branches, one going to help form the pneumogastric and the other going to the trapezius muscle. Consequently there may be a reflex action in these cases. Certainly some of you must have observed these effects. They have occurred so frequently in my hands that I do not think the observation can be an isolated one. I always try to treat my patients constitutionally, and I do not know of anything better in this class of cases than the occasional use of a purge—say two or three times a week. You will find that in the first edition of my work, published in 1872, I spoke of a peculiar form of pharyngitis which occurs during adolescence, and which I considered the result of overfeeding. While it had not attracted any attention, I still thought it sufficiently important to devote rather more space to it than to other affections, and reprinted it in the second edition of ten years ago. I have found very little reason to modify those opinions. These cases are certainly better treated by purging and attention to the general health than by local applications.

Dr. Delavan: It has been my custom for several years in dispensary work to decline to treat cases of pharyngitis or laryngitis in the habitually intemperate. In a few cases I have persuaded the patients to give up the abuse of alcohol in view of the fact that the condition of their throats alarmed them. In the process of that reformation their local condition has improved. I think we pay too little attention in this country to the benefits of good hygienic surroundings, such as may be found at various baths abroad. The treatment pursued at many of them is extremely beneficial in a large number of cases of impaired digestion, disturbed portal circulation, and lithæmic diathesis. I have observed in gouty subjects with acute throat troubles great benefit from the administration of the salicylates. As to constipation, it is an almost constant accompaniment in many chronic conditions of the pharynx, and I have for some time been in the habit of prescribing in these cases the official compound pill of aloes and iron, one pill to be taken at bedtime with a copious draught of water.

Dr. Langmaid: My paper is founded on actual experience, but I do not wish to consume time with the narration of cases. I remember the chapter in Dr. Cohen's book referred to by him, and I also remember that I was surprised to find it there. I think Dr. Cohen might have gone farther, and have found that many so-called cases of croup in children, spasm of the glottis, would be more quickly relieved by some cathartic than in almost any other way. A little investigation would bring out the fact that the children had disordered intestinal tract. Two or three years ago a lady was brought to me with disease of the upper jaw, the supposition being that I would remove the jaw. There was nothing to indicate the cause of the disease. I will only say that the operation was not performed and that the patient is in perfect health to day. I presume the

treatment by some would have been to cut the bone away, but had it been done I do not believe the patient would be well yet, while, by taking into consideration constitutional causes, I saved the patient's jaw and my reputation.

Paper.

SUCCESSFUL REMOVAL OF A PIN FROM THE LARYNX TWO YEARS AFTER IT HAD BEEN SWALLOWED.

By S. W. LANGMAID, M. D.

ON April 23, 1885, Miss C., twenty-four years old, accountant in a large manufacturing establishment, consulted me for hoarseness, ill health, and loss of flesh. The cause of these symptoms was thought by Miss C. to be in some way connected with the swallowing of a pin three months previous to this visit.

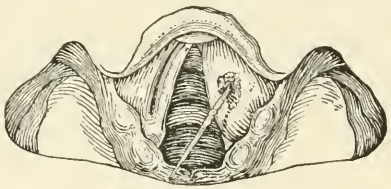
The pin, a large one, used to secure bank-notes in bundles, was held in the mouth and in some way was drawn into the throat. In the patient's words, "I came near choking to death. My face was so black (congested) that the blood settled under the skin." The physician who was summoned employed the bristle probang without obtaining the pin. The voice became hoarse, then natural, and again hoarse. Eight or ten pounds of weight have been lost. There is occasional cough, but it is not a marked symptom. Slight difficulty is experienced in swallowing food.

Dr. F. I. Knight happened to be in my office and was kind enough to examine the throat of the patient with me. All that we found was a tumor, ovoid in shape, extending partly across the back wall of the pharynx, by my estimate half an inch above the level of the arytenoids. A view of the glottis was not obtained at that interview. I made at that time the above record, and at a subsequent visit the additional remark that "the tumor seems to be the result of excessive granulation." Subsequently, as this tumor disappeared under treatment by escharotics, the glottis was exposed, and it was found that the topography of the left side of the glottic and supra glottic region was lost. The vocal band could not be distinguished from the ventricular band on account of swelling and universal congestion. On the anterior portion of this swelling, in the region of the ventricular band, I found some small vegetations, which were removed by successive operations. The tumefaction gradually disappeared, the speaking voice was restored, and the former weight of body was regained. A small ulceration on the ventricular band remained, but the patient was so well satisfied with the result of treatment that, although somewhat hoarse, she would not have called upon me again had I not requested her to do so. By this it may be seen that the presence of a pin in the throat was not revealed by rational signs. But I was not satisfied,

and I wondered at the persistent small but deep ulceration on the ventricular band, which was unlike anything I had ever seen, except in the pharyngeal tumor of the same patient, which has been described above, and which had disappeared.

Three months ago, at her last visit, there had been no change in the appearance of the larynx, except that a minute black point was seen in the center of the ulceration on the band. This I ascribed to some new point of necrotic process. On May 23, 1887, Miss C. appeared because I had asked her to do so, not because of any new symptoms. One look into the larynx revealed the presence of a pin protruding from the ulceration on the ventricular band obliquely backward and upward above the arytenoids toward the posterior wall of the pharynx, in which the point seemed to be imbedded, but which afterward was seen to move freely in the pharyngeal cavity.

Dr. Knight, being again asked to examine the larynx, agreed with me in the foregoing description. The accompanying cut, from a drawing by my friend, Dr. H. P. Quincy, accurately illustrates the position of the pin.



At the first attempt at removal the pin was well grasped where it emerged from the band by Mackenzie's small forceps, but could not be extracted from lack of power in the forceps. The second attempt with Mackenzie's large laryngeal instrument was successful, a surprising amount of forcible traction being required. After removal it was found that almost exactly one half of the pin, which measured four centimetres, had been projecting above the surface of the ventricular band.

The resulting hæmorrhage was insignificant. One week after the operation the larynx was almost normal in color, the swollen ventricular band had receded to its normal position, and no lesion of the true cord could be discovered. The voice was in all respects normal.

With regard to the origin of the pharyngeal tumor, which was seen at the first examination of the patient's throat, whether or not this was the site of the entrance of the pin and what its migrations were, are entirely matters of conjecture.

Discussion.

Dr. F. I. Knight: This case of Dr. Langmaid's was the most interesting one of foreign body which it has been my opportunity to see

for a long time. My idea regarding the location of the pin is that it had worked out of its bed in the pharynx, and gone down into the larynx, entered the ventricular sinus, thence worked its way up through the ventricular band, and was found emerging from the ventricular band, pointing from before backward, as described by Dr. Langmaid.

Presentation of Instruments.

AN ELECTRIC NASAL SAW.

By JOHN O. ROE, M. D.

THE instrument herewith presented is a nasal saw, which I have devised to be worked by an electric motor. The mechanical construction of this device is illustrated by the accompanying figures.

In Fig. 1 is shown a view of the complete instrument, which consists essentially of the reciprocating plunger P, carrying the nasal saw X, which is firmly held at the end of the plunger by the clamp O, drawn tightly around the end of the saw by means of thumb-screws. This plunger moves in the shell B, to which is attached the shield A.

Fig. 2 represents the interior of the shell B, and the mode in which the shield A is attached to it. The interior of the shell is cylindrical, with the rectangular opening P in the upper end. The hollow shield A is inserted into the lower end of the shell, forming the step *a*.

In Fig. 3 is represented the mode in which the plunger is fitted in the shell already described.

The construction of the plunger itself is shown in Fig. 4. The end of the plunger P, which carries the saw, is rectangular, as shown in the cross-section (Fig. 5), and fits nicely into the correspondingly shaped opening P (Fig. 2) in the upper end of the shell B, in which it is permitted to slide forward and backward. The rest of the plunger P is cylindrical and is nicely fitted to the interior of the shell B, which thus acts as a guide to steady the motion of the plunger, and which is bored out longer than the plunger to allow space for the length of the stroke or travel of the plunger. The cylindrical end of the plunger (Fig. 4) P is bored out so as to receive the revolving cylinder C (Fig. 6), which is formed on the end of an ordinary drill-shank D. This cylinder has a shoulder near the end where the shank D is attached to it, and this shoulder forms a

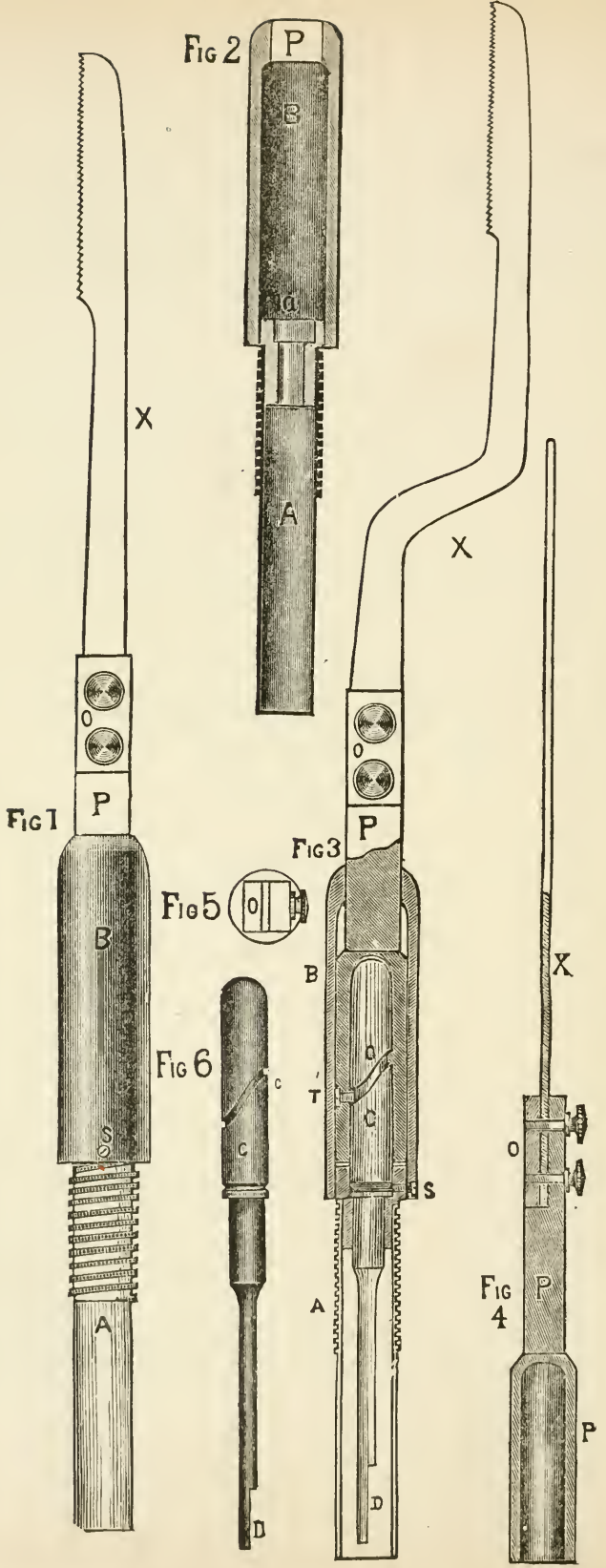


Fig 2
P
B
a
A
X
O
P
Fig 1
B
S
A
Fig 5
O
Fig 6
c
C
D
X
O
P
Fig 3
B
a
T
C
S
A
D
X
O
P
Fig 4
P

bearing which is supported by and revolves on the step *a* (Fig. 2), already referred to.

Near the shoulder a small groove is turned in the cylinder C, so as to receive the point of the screw *s* (Fig. 3), which passes through the shell B, thus preventing any longitudinal movement of the cylinder, but permitting it to revolve freely.

Near the middle portion of the cylinder C is the spiral groove *c*, which is formed around it and which returns upon itself, thus forming a cam in the surface of the cylinder. When the cylinder C is inserted in the plunger P, the small screw T (Fig. 3), whose head is completely beneath the surface of the plunger, has its point projecting into the groove or cam *c*, just described.

To operate the saw it is simply necessary to slip the socket A on the end of a dental drill and attach the shank D to the cable by means of the ordinary chuck, the shank being shaped so as to fit the chuck. If now the cable is revolved by means of a motor of any kind, it is evident that the cylinder C will revolve in the plunger P, and the groove or cam *c* will force the screw T to travel forward and backward, carrying the plunger P and the saw X with it, thus giving the latter a reciprocating movement, the rapidity of which can be regulated by the speed of the motor.

The whole arrangement is simple and compact. It can be attached to the handle of the dental drill in a moment, and, if properly made, of good material, it will not get out of order with any ordinary usage, as all springs are avoided, and the operation is positive in every particular.

The superiority of the saw, in nearly all cases, over other devices for the removal of bony growths or bony deformities of the nasal passages, and especially of the nasal septum, has been very clearly and ably shown by Dr. Bosworth.*

Its marked superiority consists in its leaving, if properly manipulated, an even and smooth surface, and therefore no irregularities in which secretions may accumulate and become inspissated, as is often the case after the use of burrs or drills.

There are two advantages possessed by this saw propelled by electric power instead of by the hand. They are the greater accuracy and rapidity with which the operation can be done.

There are two blades attached to this saw—one straight, and one set at an angle, as shown in the cuts.

* "Med. Record," New York, January 29, 1887, vol. xxxi, p. 115.

The object of the angular blade is to throw the body of the saw and the hand below the line of vision, so as not to obstruct the view of the blade while operating.

In using the hand-saw it is difficult to make the to-and-fro movement of the hand so steady and uniform as not to displace the blade of the saw, particularly in starting it; but with this saw, propelled by power, it can be held in the hand firmly and steadily at the exact spot where it is wished to cut, the motor being started and stopped by simply closing and opening the current by means of a push-button placed on the floor and controlled by the foot.

It is seen that each revolution of the motor gives the blade of the saw a backward and forward movement, so that a speed of fifteen hundred or two thousand revolutions gives the blade a corresponding number of strokes. It can be at once seen that a bony projection which will require a considerable period of time to cut through with the hand-saw can with this device be cut through very quickly.

The length of time required in some cases to cut off a hard bony outgrowth with the hand-saw is often an objection to its use, for not unfrequently patients have fainted, not on account of pain, for that can be entirely prevented by the use of cocaine, but on account of the mental association or unpleasant sensations produced by the vibrations of the saw. This is entirely avoided by the rapidity of the action of the electric saw, and the quickness with which the operation can be performed.

It might be feared that this rapidity would endanger the cutting of parts not intended to be cut. This is not to be feared, for the hand of the operator can be so firmly secured or rested against the face or upper jaw of the patient as to give him the greatest security and accuracy in controlling the blade of the saw. Also, the saw can be stopped almost immediately by breaking the current to the motor.

The application of the surgical engine or motive power to nasal surgery is due to Dr. Goodwillie,* and in some operations in the nose his revolving knives, nasal drills, and burrs are superior to any other instrument devised. So are the nasal trephines devised by Dr. Curtis,† and the nasal drills and nasal planes devised by Dr. Jarvis;‡ but for the removal of redundant bone tissue from the nasal

* "Extirpation of the Bones of the Nose and Mouth by the Aid of the Surgical Engine." "Med. Record," New York, July 12, 1879, vol. xvi, p. 28.

† "New York Medical Journal," vol. xiv, 1887, p. 596.

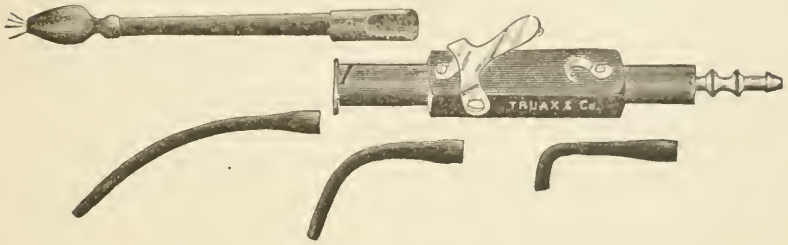
‡ "Medical Record," New York, 1887, vol. xxxi, p. 408.

passages, and especially from the septum narium, where the surfaces should be left smooth and straight, a perfectly and rapidly working nasal saw, propelled by a motor easily and quickly controlled, like the electric motor, is *par excellence* the instrument to be employed.*

A UNIVERSAL SCOOP POWDER-BLOWER AND A UVULAR HEMOSTATIC CLAMP.

By E. CARROLL MORGAN, A. B., M. D.

DR. MORGAN exhibited a *Universal Scoop Powder-blower* suitable for office work or outdoor practice, which can be worked at pleasure by either rubber bulbs or the compressed-air office receiver.



The instrument is of hard rubber, and has removable screw-tips for antero-nasal, post-nasal, pharyngeal, laryngeal, aural, vaginal, rectal, and other work. These various tips have threads, and can be screwed to the instrument, thus securing perfect safety. The scoop is secured to the handle by a bayonet fitting. The air-blast which propels the powder is under the control of a trigger-valve, the spring of which can be made of any desired resistance, from a hair trigger up.

A pair of rubber bulbs are to be attached to the bayonet fitting seen in the cut, at the end of the handle, and to the right of the trigger.

To work the instrument, select and screw on the required tip, and take up the desired amount of powder by the scoop, which is to be slipped into the handle.

Work the bulbs until they are sufficiently distended. The trigger-valve will prevent the escape of air until you have the instrument in position and are ready to discharge it by pressing the trigger.

By means of the shovel or scoop the exact quantity of powder which

* This electric nasal saw has been made for me by Chr. E. A. Grönbech, 205 East Thirty-fourth Street, New York. I use the Challenge motor, which is also made by him. This is run by a Gibson storage battery, which is charged with the Edison current.

it is desirable to apply to a diseased part can be readily measured and as accurately insufflated.

It will be seen that in using this powder-blower no sucking up of mucus and caking of powder in the end of the tube, so common in other insufflators, can possibly occur.

Again, the instrument being really an air-gun charged with compressed air and loaded with a known quantity of medicine, by simply touching the trigger the powder is discharged. It is not necessary to make sudden pressure upon a bulb, which results often in throwing the end of the insufflator, and thus the powder, away from the diseased part, and, in case the bulb is allowed to expand prior to withdrawal, in the filling of the extremity of the insufflator with foul secretions.

When the instrument is to be worked by the office air-receiver the ordinary cut-off is simply attached to the metallic fitting provided on the handle, the cut-off being locked back and the air-blast controlled by the trigger as when using the bulbs. The small hook on the handle beneath the trigger is to lock it also if desired.

This instrument has in a modified form the better qualities of several insufflators and some original points, which render it the most desirable powder-blower procurable. It is made by Charles Trnax & Co., Chicago, and can be obtained with a straight handle as shown in the cut, or with the handle placed at an angle of 45° to the staff of the instrument.

Dr. Morgan next presented a *Uvular Hæmostatic Clamp*, an improvement on the novel device (a shirt-sleeve clip) with which he succeeded in controlling the dangerous and protracted bleeding following a staphylotomy in March, 1885. The particulars of this, as well as of twenty-

three similar cases collected by Dr. Morgan, are published in the "New York Medical Journal," October 16 and 23, 1886, and in the "Transactions of the American Laryngological Association" for 1886. The accompanying cut explains the instrument, and it is only necessary to add that the clamps are made with springs of three strengths, that the small perforation seen where the arms join is for the attachment of a safety thread, and that the clamp may occasionally aid in performing posterior rhinoscopy.

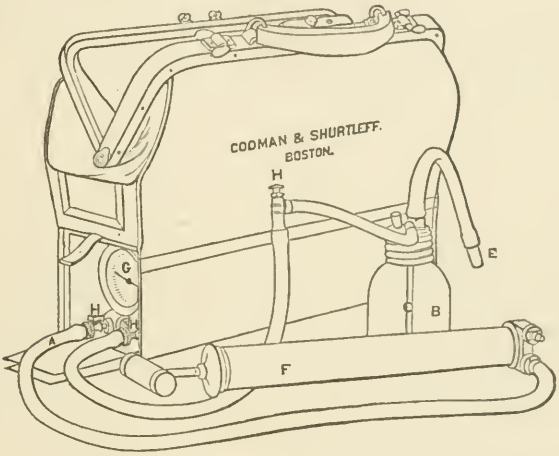
The unfortunate accident demanding the employment of this instrument may not occur in a life-time, and, though efficient, it is not destined to have a wide field of usefulness.

A VISITING BAG.

By T. A. DE BLOIS, M. D.

DR. T. A. DE BLOIS, of Boston, exhibited a visiting bag contrived not only to carry the necessary instruments used by the laryngologist, but also to contain, in the bottom, an apparatus for compressed air.

Below the upper compartment of the bag there is a square tin box containing a cylindrical tank of brass, tested to fifty pounds pressure. The end of the bag is opened by a leather flap, displaying a pressure-gauge, G, and ground couplings, H, to connect with the rubber tubes, A, from the air-pump and to the spray-tubes.



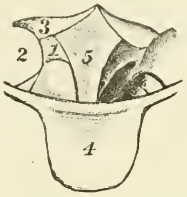
The upper part of the bag contains easily a powerful air-pump, F, a set of spray-tubes, and a small-sized inhaler, B, for the lungs. A few seconds only are required to produce, with little exertion, a pressure of thirty pounds, and thus the physician has always with him the means of administering sprays or inhalations when he may need them most. The bag is manufactured by Messrs. Codman and Shurtleff, of Boston.

Paper.

By J. SOLIS-COHEN, M. D.

DR. SOLIS-COHEN stated that on several occasions of late years he had noticed a small muscular-looking mass of red tissue at the top of the pharyngeal orifice of the Eustachian tube, with a white, glistening,

tendinous-looking extension, reaching to the middle line of the anterior portion of the vault of the pharynx. This looked very much like muscle and tendon, and presented no analogy to bands of adhesions and morbid thickenings sometimes seen in the same region. He demonstrated the shape and position of this tissue by a diagrammatic sketch on the black-



board (figure), and asked whether other members of the Association had ever noticed anything similar. In the few examinations he had made on the dead subject he had never seen anything of the kind.

Business Meeting.

It was moved that the Association proceed to the election of Fellows.

The name of Dr. A Jacobi, of New York, having been proposed as an active Fellow, it was moved by Dr. Beverley Robinson that the said proposal be amended, and that Dr. Jacobi be made an Honorary Fellow of the Association. This amendment was objected to as being unconstitutional, but, after some discussion, was finally sustained by the chair, and, having been put to vote, was accepted, and Dr. Jacobi declared elected.

The names of Dr. A. Gouguenheim, of Paris, and Dr. E. J. Moure, of Bordeaux, France, having been proposed by Drs. Hooper and Delavan, respectively, and recommended by the Council, for Corresponding Fellowship to the Association, both were unanimously elected.

The election of officers being in order, it was moved that the Secretary be directed to cast the vote of the Association for the nominees presented by the Committee. Adopted.

The tellers reported the following officers elected:

For President.—Rufus P. Lincoln, M. D., New York.

For First Vice-President.—John N. Mackenzie, M. D., Baltimore, Md.

For Second Vice-President.—Samuel W. Langmaid, M. D., Boston, Mass.

For Secretary and Treasurer.—D. Bryson Delavan, M. D., New York.

For Librarian.—Thomas R. French, M. D., Brooklyn.

For Member of Council.—E. Carroll Morgan, M. D., Washington, D. C.

Dr. J. Solis-Cohen announced that at the next meeting he would propose an amendment to Section III, third paragraph, relating to the limitation of membership of the Association.

Dr. Frank Donaldson, Jr., recommended that certain changes be made in the method of the arrangement of the programme, and of the order of publication of papers. Referred to the Council.

It was moved by Dr. Roe that a vote of thanks be tendered the Secretary of the Association for his services. Carried.

Adjourned.